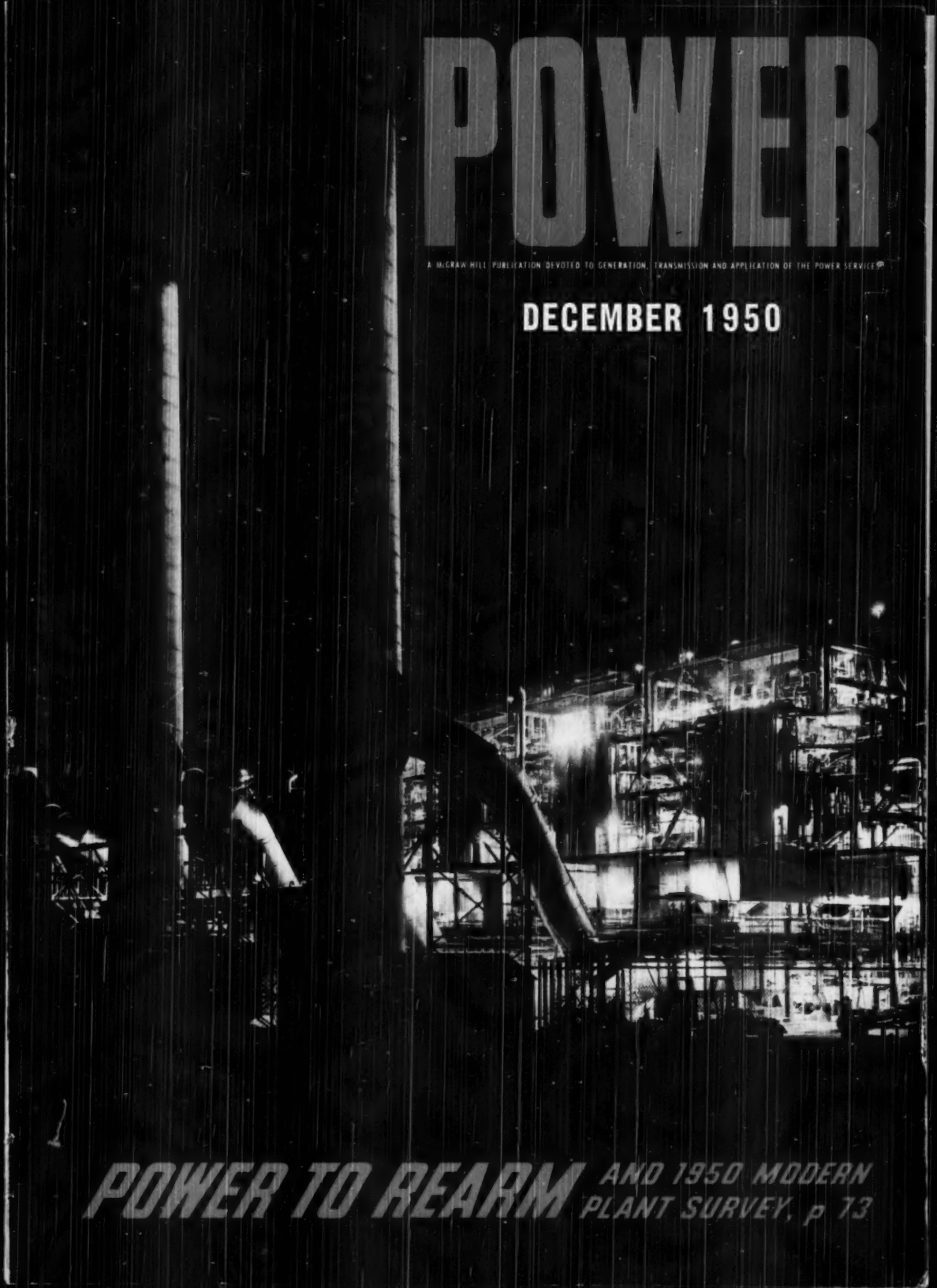
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICE®

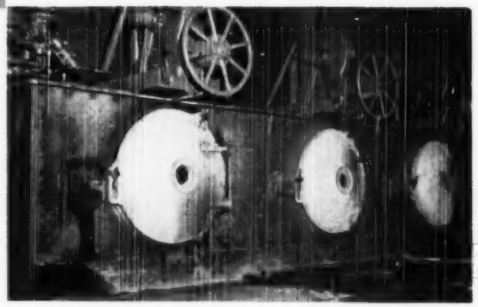
DECEMBER 1950



POWER TO REARM

AND 1950 MODERN PLANT SURVEY, p 73

MODERN TO THE LAST DETAIL



Acclaimed throughout the industrial power world, this new 800,000-lb-per-hr 1250-psi 830-F cyclone-fired plant incorporates the best engineering ideas of today. From the top of the stack to the ash basement, everything has been done to insure peak efficiency and economy. Naturally, the ash removal equipment is Hydrojet . . . the last word today . . . the last word tomorrow.

Whenever and wherever ash handling is a problem, you can be sure that the Hydrojet answer is the right one. Get it first.

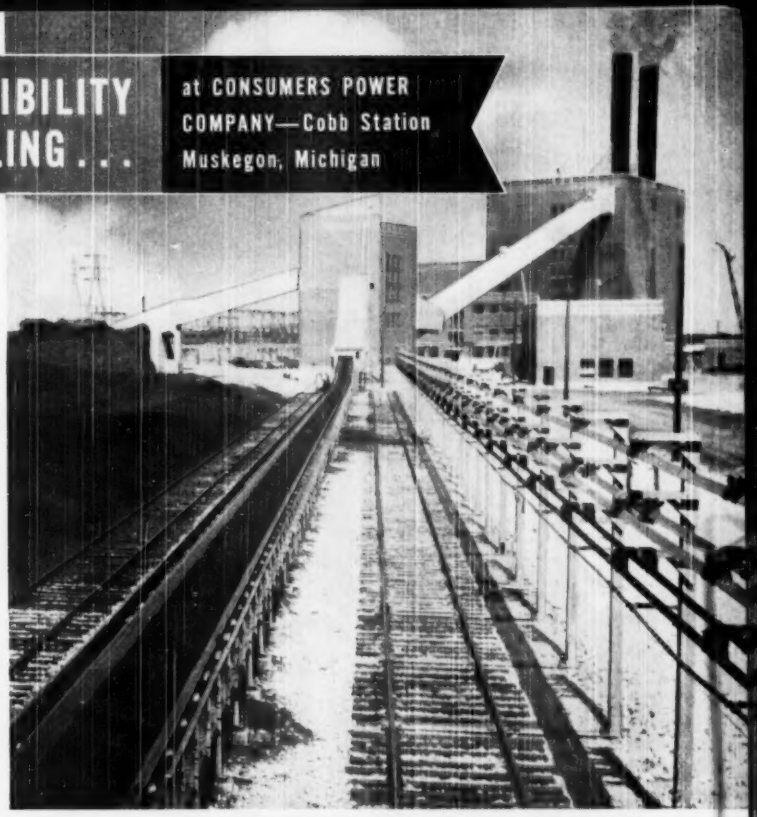
HYDROJET ash handling system

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. *Offices & Representatives in Principal Cities*

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer") December, 1950, Vol. 94, No. 12. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least 10 days for change of address. Subscription rates, U. S. and U. S. possessions, $5 for one year, $7 for two years, 65c per single copy. Canada $7 for one year, $11 for two years. Pan American Countries, $10 for one year, $16 for two years. All countries $15 for one year, $23 for two years. Please indicate position and company connection on all subscription orders.

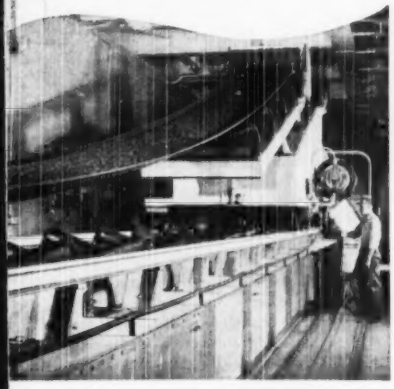
CONVENIENT FLEXIBILITY in COAL HANDLING . . .

at CONSUMERS POWER COMPANY—Cobb Station
Muskegon, Michigan



View of the yard conveyor carrying coal to the feeder conveyor in the breaker house, thence to the coal bunkers.

The Link-Belt motor-driven, traveling tripper with stack conveyor removes all or any part of the coal from the 1230-foot-long yard conveyor.



A close-up of the 42" wide belt conveyor and the Link-Belt motor-operated, traveling tripper distributing the coal to the bunkers. Note the plow on the discharge chute which opens and closes the bin seals for maximum dust confinement.

LINK-BELT COAL-HANDLING SYSTEM INCORPORATES SELECTIVE HANDLING, STORAGE AND RECLAIMING

At this new, modern generating station the coal is brought to the dock in bulk freighters and in self-unloading boats. From the bulk freighters the coal is carried by crane to a feeder belt conveyor, thence to a transfer belt conveyor. The self-unloading boats discharge through a hopper to the transfer conveyor.

This transfer conveyor, with two speeds, carries 1200 or 1800 tons an hour to the open-belt yard conveyor which is 1230 feet long and has a choice of three speeds, two for unloading the boats, and one for reclaiming coal from storage. For storing coal, a motor-driven traveling stacker removes the coal from the yard conveyor. In reclaiming, a crane loads the yard conveyor. By varying the speed of the feeder from the reclaiming crane, coal from the boats and storage can be mixed in any desired proportion.

The yard conveyor also discharges through a chute on to a feeder in the breaker house. From this feeder the coal passes through a magnetic separator and either through or by the breaker to the plant conveyor where a Link-Belt traveling tripper distributes it to the bunkers.

A reclaiming hopper, feeder, and conveyor to the breaker house is available for reclaiming coal from storage in case of failure of the reclaiming crane.

This is a good example of Link-Belt engineering in modern coal handling. Link-Belt equipment and "know how" may be the way out of your coal-handling difficulties — whether in a public utility or industrial power plant. A modern system engineered to meet specific conditions does cut handling costs. Why not ask our nearest office for more particulars.

12.724-A

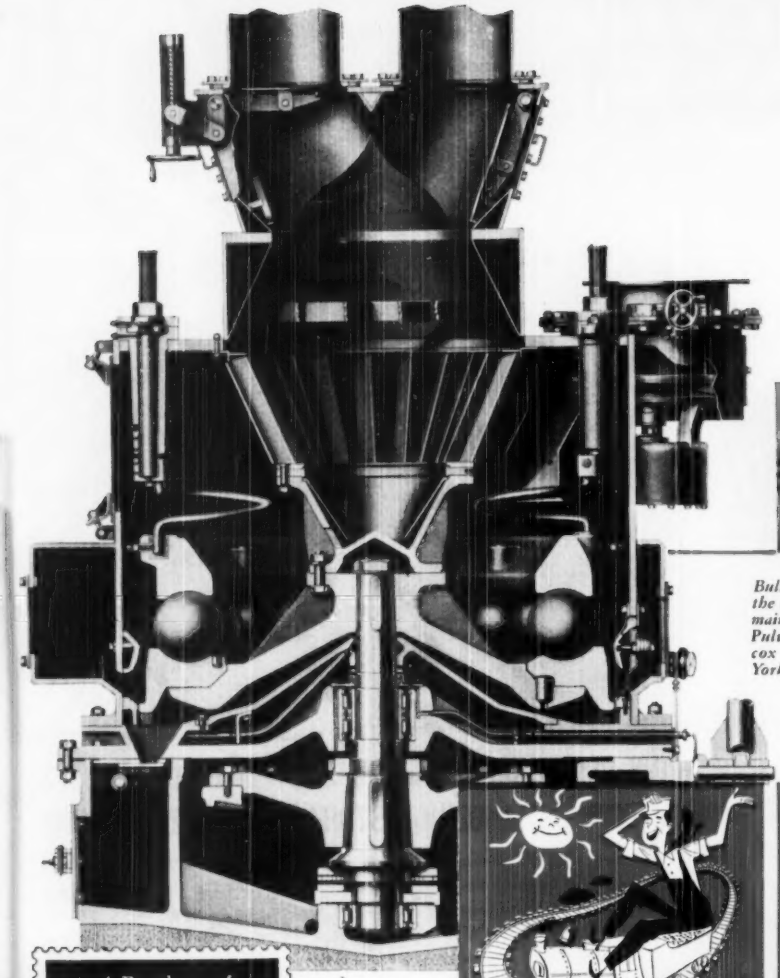
LINK-BELT

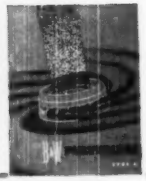
COAL HANDLING EQUIPMENT

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

12.824





Bulletin G-57 illustrates and describes the design, construction, operating, and maintenance features of the Type E Pulverizer. Write: The Babcock & Wilcox Company, 85 Liberty Street, New York 6, New York.

A Product of B&W Engineering for Economy

Recirculating Load—Dries as It Grinds

Recirculation of fines within the mill gives repeated, quick-drying contact with large masses of heated air and metal . . . produces proper fineness at all loads, even with coal as wet as it can get. Fines are classified in the mill.

Uniform Performance Regardless Of Wear

Balls and grinding rings wear together . . . assure uniform fineness regardless of attrition of the grinding elements . . . fineness automatically increases at reduced loads.

A big asset in *low-cost* power generation

The only accurate measure of pulverizer efficiency—*and ultimate cost*—is a function of availability, plus combined materials and labor maintenance per ton of product over long periods of continuous operation. B&W recently surveyed a representative group of utilities, covering a wide geographical area and broad range of coals. More than 100 B&W Type E mills were reported in service from one to ten years, and with aggregate product of 25 million tons:

- Average Availability: 96.5%
- Average total maintenance cost per ton: 3.12 cents

It will pay you to remember this outstanding—and typical—history of dependable, low-cost performance when considering your next pulverizer installation.

Blows Clean Air—Saves Wear and Tear

Unique in pressurized operation, the Type E Pulverizer requires remarkably little maintenance of the primary fan, because it blows only clean air . . . is not subject to the damaging abrasion of entrained particles.

One-Point Variable Fuel—Air Control

Like the accelerator on your automobile . . . assures proper coal-to-air mixture . . . produces desired rate of steam generation over a wide range with coal conditions suitable for sustained high combustion efficiency.

Low Power Consumption

Ball-and-ring grinding, antifriction bearings, pressure lubrication, and automatic rejection of ungrindable materials make possible high output with minimum power demand.

Outstanding Performance Record

Availability and maintenance economy beyond today's most exacting requirements are proved in over 1300 Type E Pulverizer installations.

Helping Industry Cut Steam Costs Since 1867

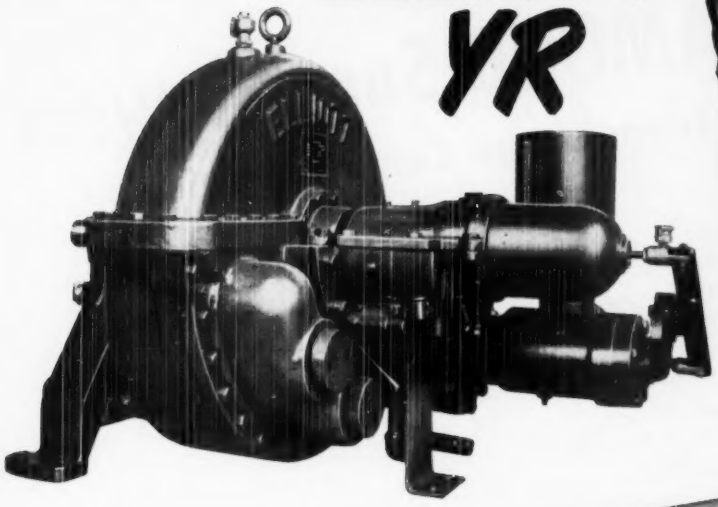
BABCOCK & WILCOX

G-5191

The turbine that
Outdoor installation
Driving induced draft fans
Driving boiler feed pumps
Serving a catalytic unit
Driving reflux pump
Driving hot oil pumps
High back-pressure turbine

everyone likes...

ELLIOTT YR



Driving induced draft fans

Paper machine drives

Driving process pumps

YOU SEE THEM EVERYWHERE—in power plants, industrial and process plants, throughout the oil industry, in fact in all industries that demand reliability in mechanical drive turbines. Working indoors or out, under all kinds of conditions, operating condensing or noncondensing; sometimes operating on gas instead of steam. Although a standardized line of turbines, their flexibility results in a tailor-made unit for any type of application . . . And best of all, with the built-in dependability that lightens the load of the men whose job is to keep things running right.

Everyone likes the Elliott YR. The reasons are factually set forth in Bulletin H-16. Write for it.

ELLIOTT COMPANY

Steam Turbine Dept. • Jeannette, Pa.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. SPRINGFIELD, O. • NEWARK, N. J. • DISTRICT OFFICES IN PRINCIPAL CITIES

H-730

1950 CONTRACTS
(FIRST 10 MONTHS)

FOR

DIAMOND Soot Blowers

from Large Central Stations
(OVER 600 PSI)

ALBUQUERQUE STATION
Public Service Company of New Mexico

*ARAPAHOE STATION
Public Service Company of Colorado

ASTORIA STATION
Consolidated Edison Company

*AVON PARK STATION
Florida Power Corporation

*BENNING STATION
Potomac Electric Power Company

BLUFFS STATION
Consumers Public Power District

*BOOTH POINT STATION
Florida Power Corporation

*BURGER STATION
Ohio Edison Company

BRIDGEPORT STATION
Tennessee Valley Authority

BRUNSWICK STATION
Georgia Power Company

CARIBOU STATION
Maine Public Service Company

CHATTAHOOCHEE STATION
Gulf Power Company

*CHESTERFIELD STATION
Virginia Electric and Power Company

CLERMONT STATION
Cincinnati Gas & Electric Company

DANSKAMMER STATION
Central Hudson Gas and Electric Co.

*DES MOINES STATION
Iowa Power and Light Company

*EDWARDSPORT STATION
Public Service Company of Indiana

*GOLDSBORO STATION
Carolina Power and Light Company

*Repeat contracts for same stations.

In 1950, as in '49, '48, '47, etc., leading public utilities are indicating nationwide preference for Diamond Soot Blowers. Conclusive evidence is in this list of central station contracts (complete steam generators only) above 600 psi for the first ten months of 1950. TODAY . . . as yesterday . . . "a look at the record" shows that Diamond Dominates in soot blowers.

DIAMOND POWER SPECIALTY CORP. • LANCASTER, OHIO

DIAMOND SPECIALTY LIMITED—WINDSOR, ONTARIO

Let's Look at the Record

*GORGAS STATION
Alabama Power Company

*GOULD STREET STATION
Consolidated Gas, Electric Light and Power Company

HENNEPIN STATION
Illinois Power Company

*HUTCHINGS, (O.H.) STATION
Dayton Power and Light Company

*HUTSONVILLE STATION
Central Illinois Public Service Company

*LAWRENCE STATION
Kansas Power and Light Company

*LUMBERTON STATION
Carolina Power and Light Company

MASON STATION
Central Maine Power Company

MERAMEC STATION
Union Electric Company of Missouri

MOSS LANDING STATION
Pacific Gas and Electric Company

NEW JOHNSONVILLE STATION
Tennessee Valley Authority

*OMAHA S.E. STATION
Omaha Public Power District

*OSWEGO STATION
Niagara Mohawk Power Corporation

*PADDY'S RUN STATION
Louisville Gas and Electric Company

*PHILIP SPORN STATION
Appalachian Electric Power Company
Ohio Power Company (The)

*PLANT YATES STATION
Georgia Power Company

*POSSUM POINT STATION
Virginia Electric and Power Company

*POSTON STATION
Columbus and Southern Ohio Electric Co.

*RIDGELAND STATION
Commonwealth Edison Company

*ROCKFORD STATION
Central Illinois Electric & Gas Company

ROCKY FORD STATION
Southern Colorado Power Company

*SEWAREN STATION
Public Service Electric and Gas Company

*SILVER GATE STATION
San Diego Gas and Electric Company

*SIOUX FALLS STATION
Northern States Power Company

*SOUTH AMBOY STATION
Jersey Central Power & Light Company

SOUTH FLORIDA S.E. STATION
Florida Power and Light Company

TANNERS CREEK STATION
Indiana & Michigan Electric Company

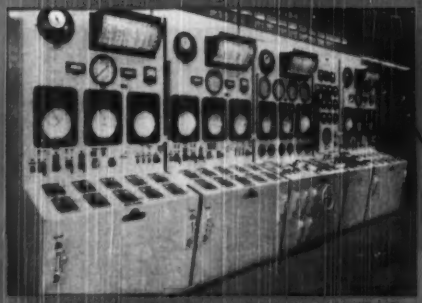
*TECUMSEH STATION
Kansas Power and Light Company

*WEST SPRINGFIELD STATION
Western Massachusetts Electric Company

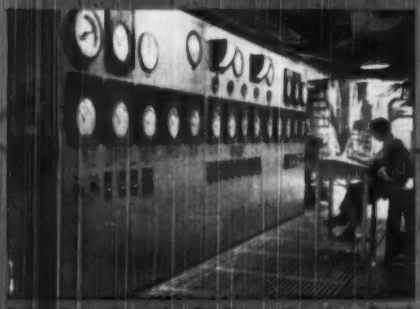
*WHITE RIVER STATION
Indianapolis Power & Light Company

*Repeat contracts for same stations.

IN SOOT BLOWERS . . . *Diamond Leadership Continues*

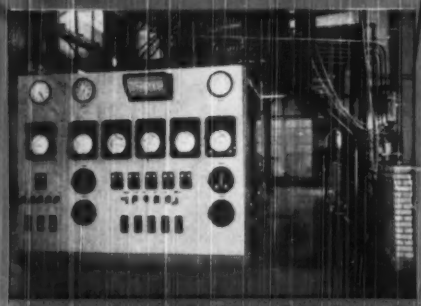


Bailey Boiler Control — Gas or Oil Firing — Pacific Gas & Electric Co., Avon Station.



Bailey Boiler Control — Oil Firing — American Potash and Chemical Corp., Trona, Calif.

Bailey Boiler Control—Gas Firing—Colorado Fuel and Iron Corp., Pueblo, Colo.



Bailey Boiler Control — Gas Firing — Public Service Co. of New Mexico, Albuquerque, N. M.

More Power per fuel dollar—that's the basic business of Bailey Meter Company. Our products and services are designed to deliver increased power plant efficiency for you, whether your plant is large or small. We have had a wealth of experience on every size and type of steam generating equipment.

Here are some of the reasons why we believe we have more to offer you in this field than any other single manufacturer:

More Complete Range of Equipment

Our fully co-ordinated line of Meters and Controls is offered for a wide variety of services and in a complete range of types. This means you need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment merely because he is unable to offer the exact one best suited to your needs. It means, too, that you need never fear a buck-passing division of responsibility for the efficient operation of your complete boiler control system.

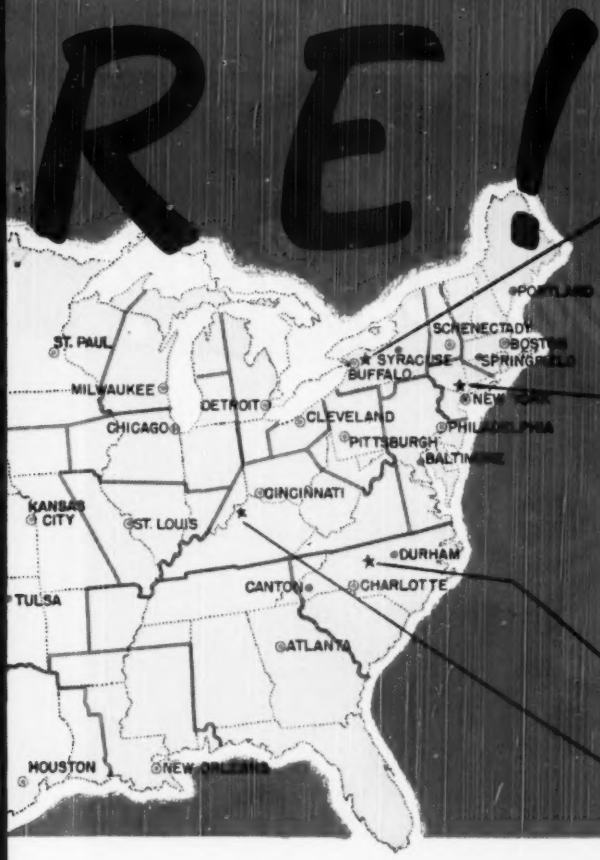
More Experienced Engineering Service

When you discuss your power plant problems with a Bailey Sales-Service

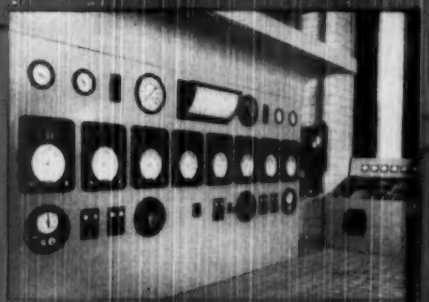
Giving More Power to You...

CONTROLS for—Combustion • Feed Water • Temperature • Pressure • Liquid Level • Feed Pumps

RE!

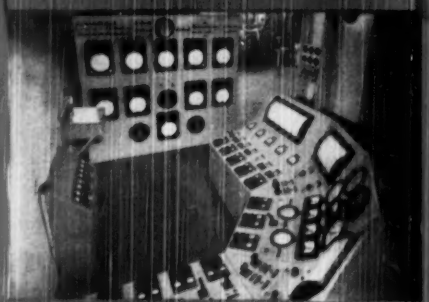


Bailey Boiler Controls—Pulverized Coal Firing—Buffalo Niagara Electric Corp., Huntley Station No. 2.



Bailey Boiler Controls—Pulverized Coal Firing—Niagara Light and Power Co., Tonawanda, N. Y.

Bailey Boiler Controls—Stoker Firing—Hanes Dye and Finishing Co., Winston-Salem, N. C.



Bailey Boiler Controls—Pulverized Coal Firing—Louisville Gas and Electric Co., Paddy's Run Station.

Engineer, you get advice from an organization with a background of more knowledge and experience in steam plant operation than any other manufacturer of instruments and controls can offer you. Our field representatives are graduate engineers with specialized training in combustion, flow measurement and automatic control. Each has completed an intensive course in theory and practice at our plant before being given a field sales-service assignment.

More Direct Sales-Service Offices

Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems. Truly, prompt and capable service—and with a minimum of travel time and expense—is as near as your telephone. In emergencies a trained Bailey Engineer is available in a matter of minutes or a few hours at the most.

Giving More Power to You

Better power plant operation calls for more power per fuel dollar, less outage, and safer working conditions. We help you to get all of these. Write for Bulletin 15G describing Bailey Meters and Control Systems.

Bailey Meter Company

1036 Ivanhoe Road, Cleveland 10, Ohio • Bailey Meter Company Limited, Montreal, Canada

America's first gas-turbine power plant for power generation is this General Electric 3500 kw unit installed at the Belle Isle Station of the Oklahoma Gas and Electric Co.

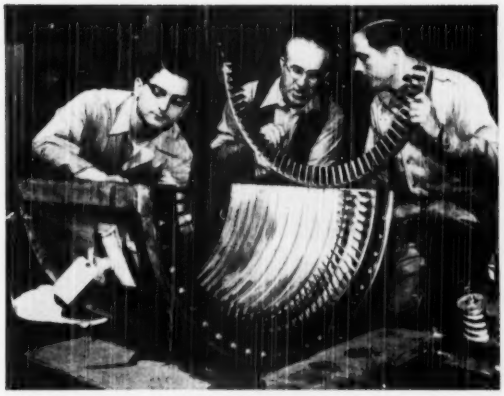
MORE Gas Turbines

AMERICA'S *New* PRIME MOVER

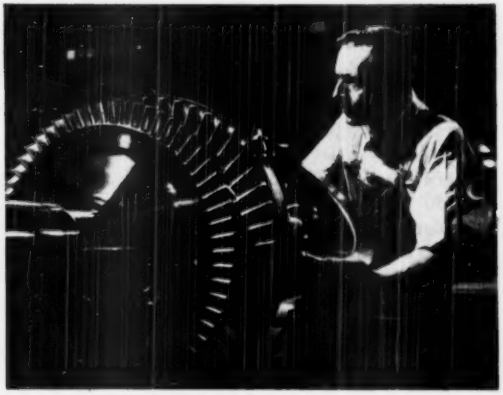
Three General Electric combustion gas-turbines—the first in America—have been placed in regular service. Full-scale production has begun on several basic designs, and in the next few months, more will be coming off the test stands in G.E.'s newly completed gas turbine factory.

The efficient, reliable and profitable performance record of the units already placed in revenue operation has established the gas turbine as an important prime mover. It offers several unique advantages: Each unit is a complete plant in itself. It is small and compact, easily operated, and requires but a minimum installation investment.

General Electric gas-turbine generators, rated 3500 kw and 5000 kw, are available to meet your requirements. They are backed by the experience that has given G-E steam turbines a position of leadership for more than 45 years. If you're interested in power generation, you'll want the facts about these new power plants. Write for your copy of bulletin GEA-5516, "Gas Turbine Power Plants," today. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Assembling compressor casings requires the supervision of experienced craftsmen. While many manufacturing experts will "grow up" with gas turbines, responsibility for producing the first units falls on the shoulders of men who have spent years building steam turbines, turbosuperchargers, and jet engines.



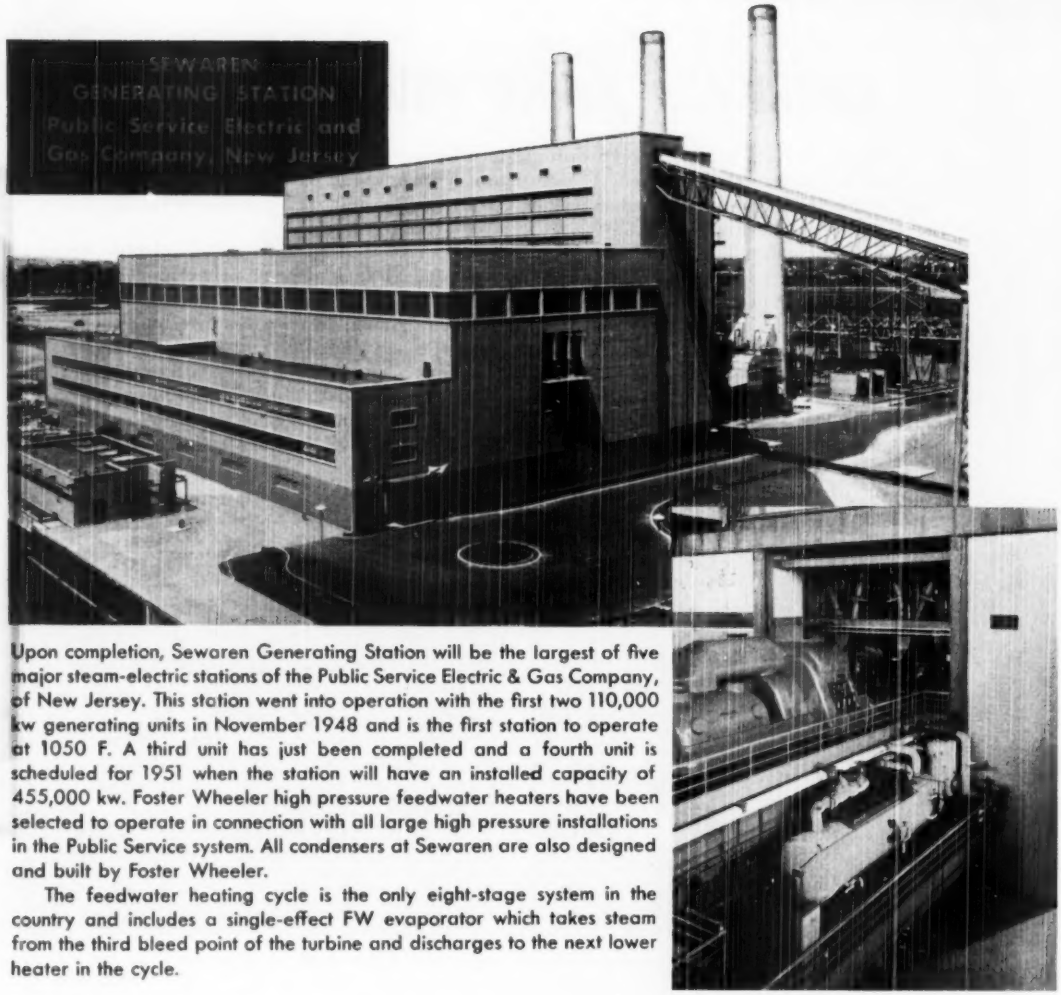
Though gas turbines require many components which may be new to the power engineer, the heart of the unit is still the familiar turbine wheel. Designed on principles established by steam turbine experience, this two-stage turbine rotor is given a final micrometer inspection before assembly in a new power plant.

GENERAL ELECTRIC

254-44

FOSTER WHEELER HEATERS and

are serving in all high pressure of the Public Service Electric



Upon completion, Sewaren Generating Station will be the largest of five major steam-electric stations of the Public Service Electric & Gas Company, of New Jersey. This station went into operation with the first two 110,000 kw generating units in November 1948 and is the first station to operate at 1050 F. A third unit has just been completed and a fourth unit is scheduled for 1951 when the station will have an installed capacity of 455,000 kw. Foster Wheeler high pressure feedwater heaters have been selected to operate in connection with all large high pressure installations in the Public Service system. All condensers at Sewaren are also designed and built by Foster Wheeler.

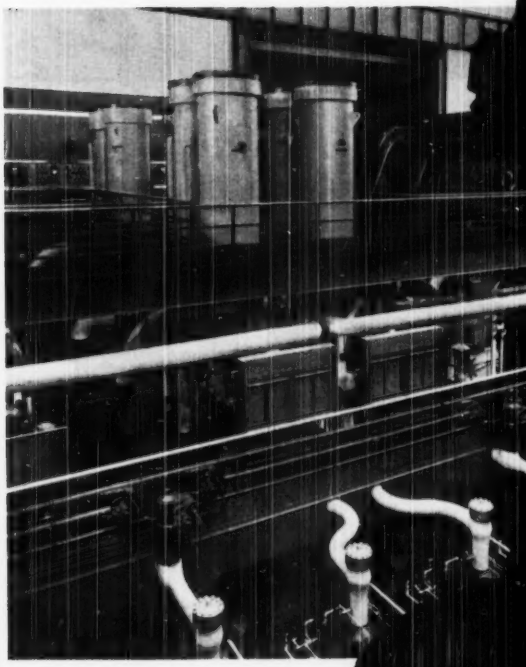
The feedwater heating cycle is the only eight-stage system in the country and includes a single-effect FW evaporator which takes steam from the third bleed point of the turbine and discharges to the next lower heater in the cycle.

This is a single-effect evaporator with an external deaerator which is included in the feedwater system of each unit at Sewaren. Two of the three exhausters serving the FW ball mill pulverizers of No. 1 Unit appear in the background.

FOSTER WHEELER CORPORATION · 165 BROADWAY, NEW YORK 6, N. Y.

EVAPORATORS

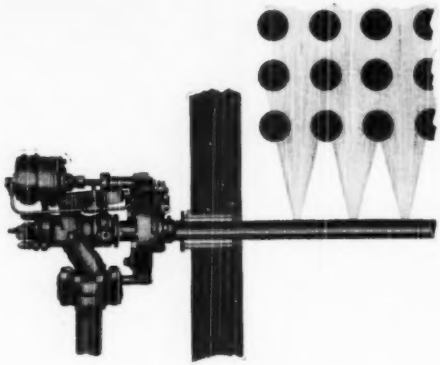
generating stations System



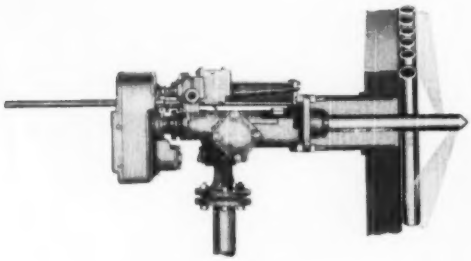
Some of the high pressure heaters serving the 110,000 kw units at Sewaren are shown above. The closure for these high pressure heaters is of the Foster Wheeler "Lockhead" type. This design provides separate means for supporting the head pressure load and the gasket compression load.

FOSTER WHEELER

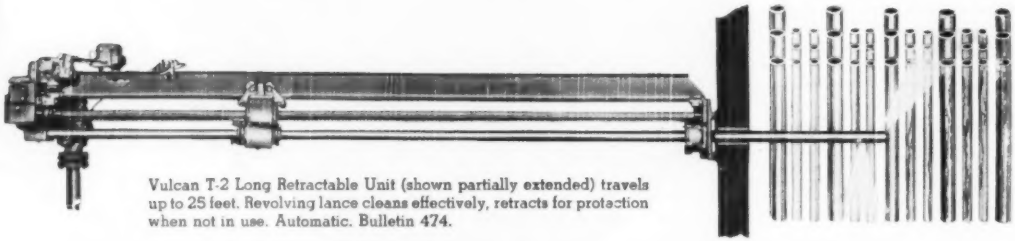
To Keep Your Automatically Look to



Vulcomatic Rotary Head, for fixed position rotary elements. Operated by push button at unit or from central control panel. Bulletin 486.



Vulcan Gun-Type Blower and Deslagger for automatic push button operation. 12- or 24-inch travel, as needed for your conditions. Bulletin 471.



Vulcan T-2 Long Retractable Unit (shown partially extended) travels up to 25 feet. Revolving lance cleans effectively, retracts for protection when not in use. Automatic. Bulletin 474.

VULCAN Automatic

BOILERS CLEAN or manually... VULCAN

You'll also cut cleaning costs no matter what size your boiler

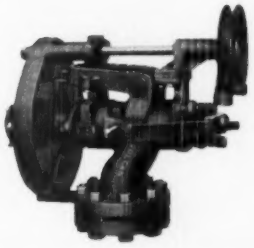
Whether you want automatic or manual soot blowing—using steam or air (or both) as the blowing medium—you'll get top performance, dependability and economy with Vulcan.

Your boilers—large or small—will be kept cleaner, their efficiency higher, because every Vulcan system is engineered for effective blowing in even the least accessible passes.

You'll burn less fuel per pound of steam generated. You'll save on maintenance, for Vulcans are built for long life, severe service.

Vulcan automatics include simple push button control at the units, or automatic sequential operation from a central control panel. Vulcan manual types offer the same basic blowing efficiency. Special designs for all types of air preheaters. Information on request.

Vulcan Gun-Type Blower and Deslagger for manual operation. Bulletin 471.



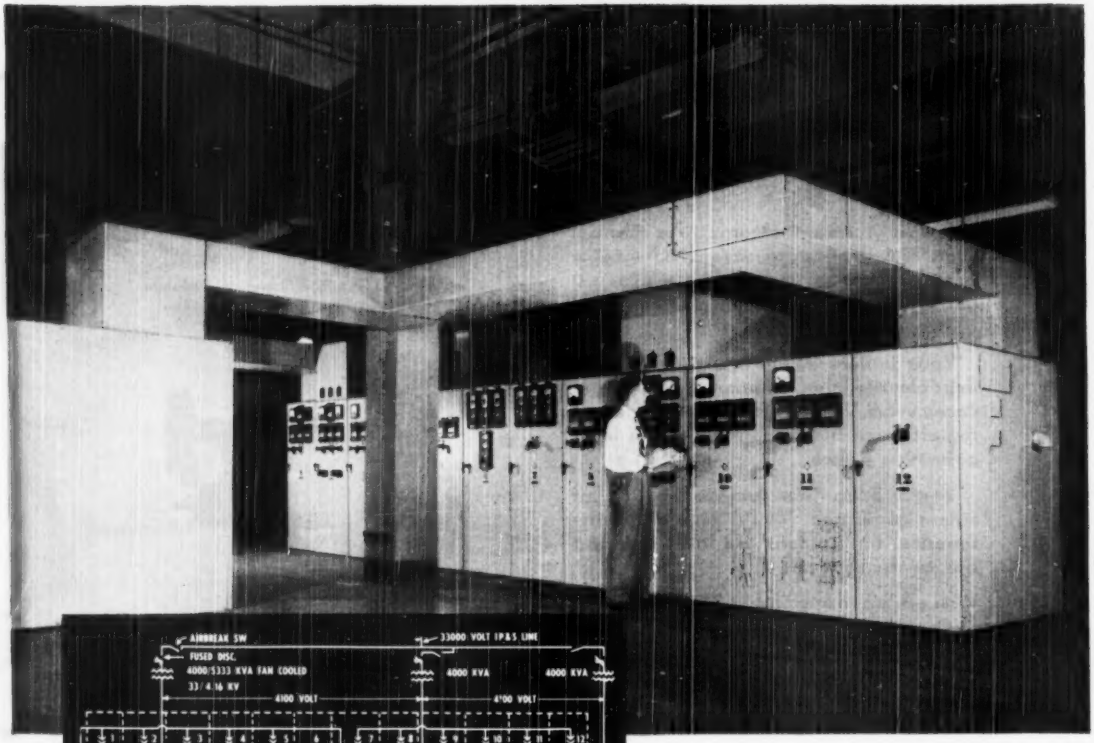
Vulcan Rotary Head for fixed position rotary elements. Bulletin 435.

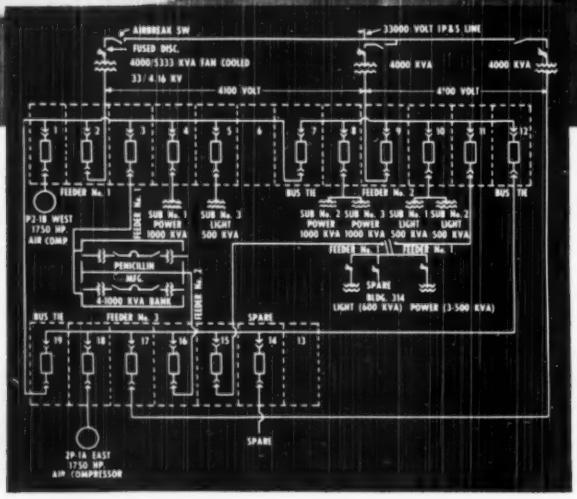
Special types available for HRT and other small boilers.

Data on request.

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DUBOIS, PENNSYLVANIA

Lilly Vital Drug by ALLIS-





Type JM 5 kv switchgear with DZ 100 B oil circuit breakers. Feeds power to complex equipment used in growing penicillin. This equipment includes 125 hp motors, compressors, electrical recording thermometers and timers.

At Eli Lilly's Kentucky Avenue plant, 33 kv is stepped down to 4160 volts through three 4000/5333 kva transformers to three DZ 100 B, 1200 ampere oil circuit breakers with overcurrent relays. Power flows in both directions to a secondary selective system through three 1200 ampere bus tie breakers. From here it is fed to the penicillin area, building 314, substations 1, 2 and 3 and to two 1750 hp air compressors.

Units 6 and 13 are bus tie auxiliaries for emergency use. Breakers protecting the air compressor have thermal, overcurrent and undervoltage relays.

Production Protected

CHALMERS SWITCHGEAR!

"Any power shut down is costly for us," say Eli Lilly and Company engineers. "It's imperative that we maintain *continuous* electrical service to prevent loss of raw materials and rapid deterioration of products in process." Their answer was 5 kv Allis-Chalmers switchgear to assure dependable circuit protection in their Indianapolis plants.

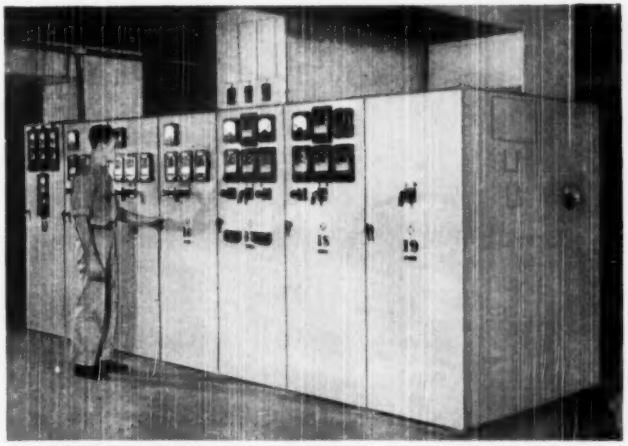
WITH LOSSES LIKE this at stake you can see why Eli Lilly engineers chose Allis-Chalmers switchgear to protect complex filtering, refrigeration, distillation, drying and heating operations.

In streptomycin production, for example, electric power is fed through standard switchgear for every stage of a 72 hour process . . . seeding, growing, fermentation and packaging.

"No maintenance to speak of" that's the A-C high voltage switchgear record at Lilly. 150,000 kva switchgear with *Ruptair* circuit breakers furnishes protection to the McCarty Street plant for liver, insulin and general pharmaceutical production.

At the Kentucky Avenue plant, Allis-Chalmers 250,000 kva, 4160 volt switchgear with oil circuit breakers controls power for production of ampules, antibiotics and general pharmaceuticals.

* * *



5 kv, 1600 ampere switchgear with DZ 100 B oil circuit breakers feeds power to the shipping department and streptomycin section of the Kentucky Avenue plant.

Is *yours* one of the many modern industrial plants that rely on standard Allis-Chalmers switchgear as essential to low cost, continuous plant operation? If not, it will pay you to investigate.

A-C switchgear is flexible. Standard units can be added as your load expands. *It's safe to operate.* Metal-clad construction is dead front for safety to personnel. Interlocks and automatic shutters protect personnel from high voltage parts and make it impossible to move the closed breaker to or from operating position.

Prefabricated, pretested, completely assembled, ready to operate when delivered! Furnished with air blast, oil or *Ruptair* circuit breakers.

See your local Allis-Chalmers sales representative or write for bulletin 71B6129D. A-3120

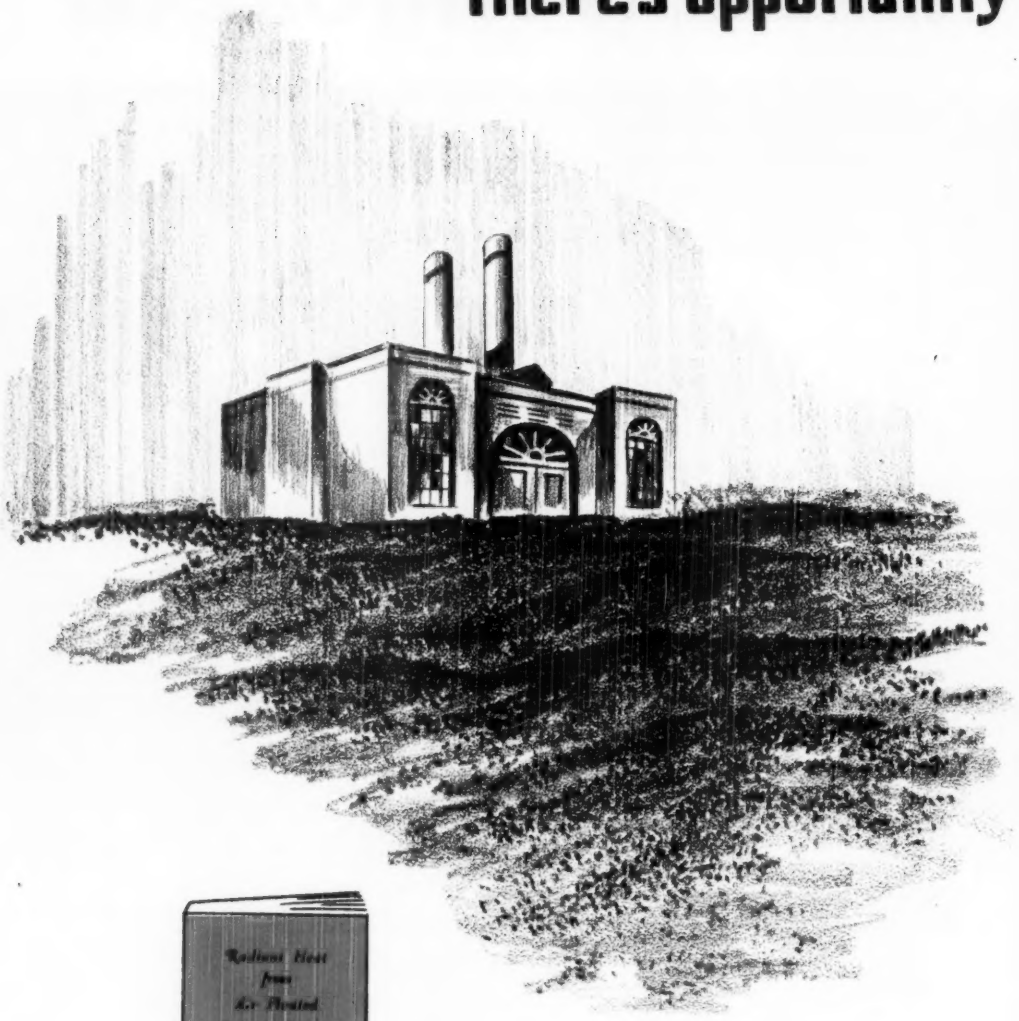
Ruptair is an Allis-Chalmers trademark.

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

First in the U. S. with Metal-Clad Switchgear

Wherever... there's there's opportunity



Send for a copy of Engineering Bulletin No. 44-B containing valuable information on steam generation and coal pulverization.

low grade fuel for low cost power—with

KVS **WORLDWIDE SERVICE**

WHETHER you're contemplating a steam power plant in the Arctic or in the Tropics . . . in the East or in the West . . . if fuel and water are available, KVS will build your plant and guarantee its performance. Low grade fuels are no handicap to highly efficient performance . . . if it's a fuel, KVS will burn it economically and deliver low cost KW's at the switchboard.

Complete plants . . . from bunker to bus bar . . . are KVS responsibility whether or not all components are built in KVS shops. Electrical equipment is included as well as the coal preparation and steam generation equipment which are designed and built by KVS.

It will be to your advantage to discuss your needs with KVS engineers regardless of where your plant is to be located, bearing in mind that your complete plant will be fully guaranteed by KVS as to overall performance.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

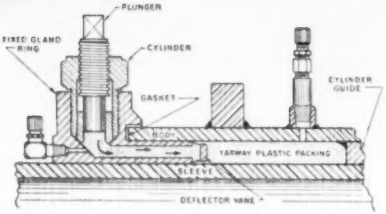
2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA

GUN-PAKT EXPANSION JOINTS

COST LESS
to maintain
require
NO SHUTDOWNS
for servicing



Close-up of cross-section showing detail of Gun-Pakt feature.

YARWAY

Maintenance costs are less because there's less maintenance.

In a nutshell, that's why more and more utilities, institutions and industrial plants distributing steam are turning to Yarway Gun-Pakt Expansion Joints.

Servicing Gun-Pakt Joints never interrupts heating or production. They are serviced under full steam pressure, without shutdowns.

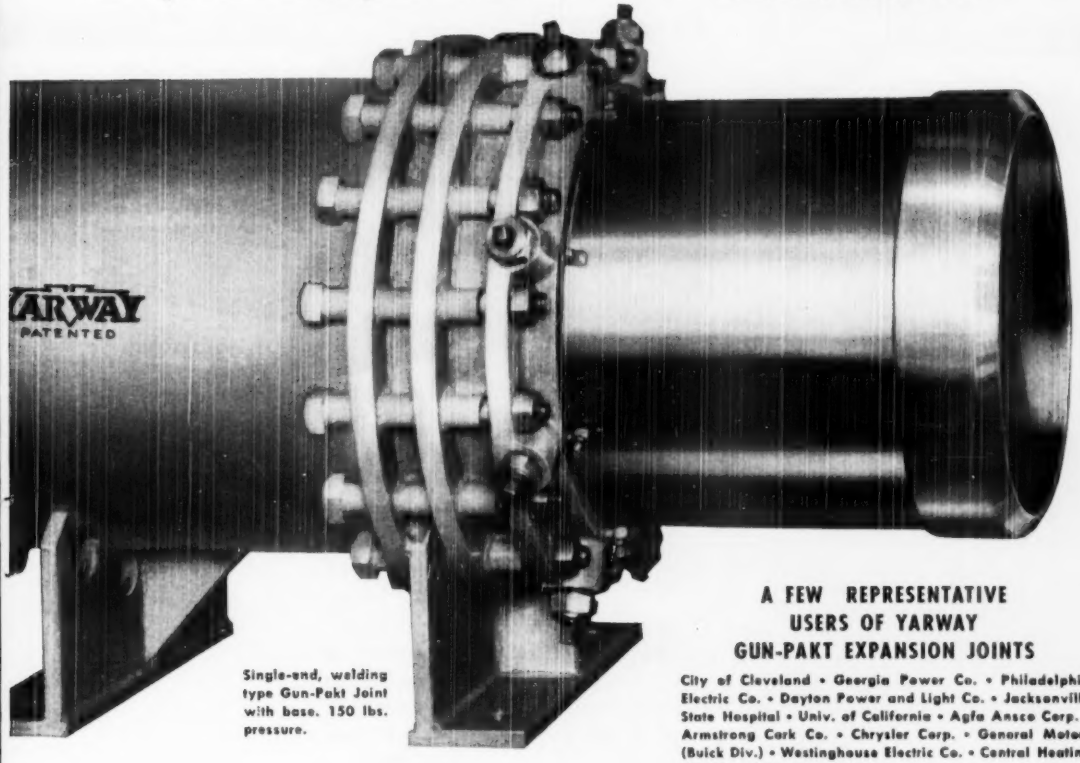
To repack a Gun-Pakt Joint you simply insert a plug of plastic packing, turn a wrench, and the job's done. Special Alemite fittings provide for proper lubrication.

Users report that Gun-Pakt Joints cost little to maintain. One who has kept accurate records says "65 cents per year per joint." Others claim even less.

Available with single or double ends, welding or flanged types, in sizes from 2" to 30", with traverses from 4" to 24", and for pressures to 400 psi.

For the full Gun-Pakt story, as well as information on other Yarway slip-type joints, write for Yarway Bulletin EJ-1912.

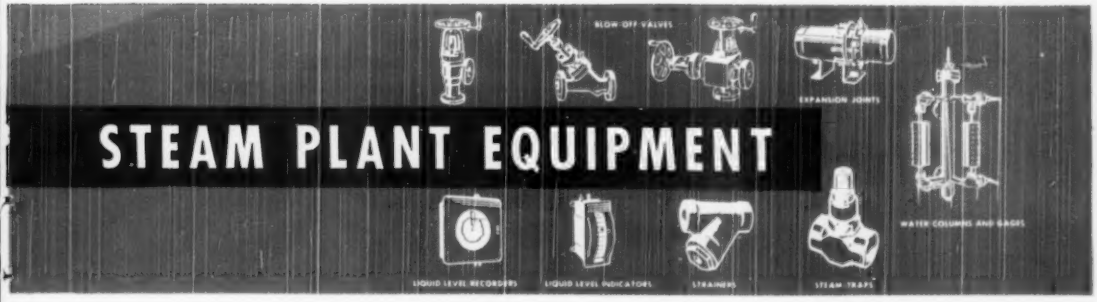
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities



Single-end, welding type Gun-Pakt Joint with base. 150 lbs. pressure.

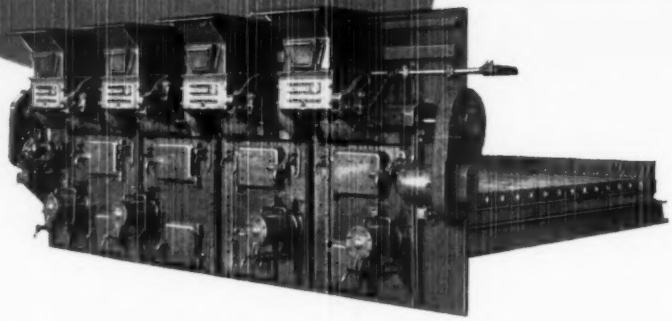
A FEW REPRESENTATIVE USERS OF YARWAY GUN-PAKT EXPANSION JOINTS

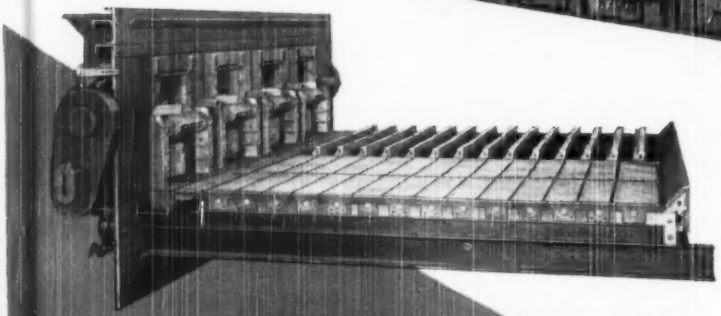
City of Cleveland • Georgia Power Co. • Philadelphia Electric Co. • Dayton Power and Light Co. • Jacksonville State Hospital • Univ. of California • Agfa Ansco Corp. • Armstrong Cork Co. • Chrysler Corp. • General Motors (Buick Div.) • Westinghouse Electric Co. • Central Heating Plant, Washington, D. C.



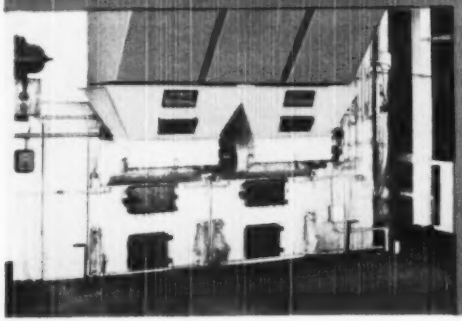
SAVING COAL IS OUR BUSINESS

Over 1800 Coal Saving—Cost cutting Installations of Detroit RetoStokers Since 1931





Power Dumping RetoStoker with four Rotors, driven by one 2 hp motor, with auxiliary turbine. A portion of the grate is shown in the dumped position. Built for Bibb Manufacturing Co., textile mill, Columbus, Georgia. Capacity, 60,000 pounds of steam per hour.



First RetoStoker Installed in 1931

This Hand Dumping RetoStoker in the Municipal Power Plant of Fort Morgan, Colorado, has been in service for 19 years—burning 9,000 B.T.U. Northern Colorado Lignite.

Our 32 Years in Stoker Manufacture Exclusively, Including 21 Years of SPREADER Stoker Experience IS AT YOUR SERVICE.

A pioneer in spreader stoker design and building, we have made applications of Roto-Stokers to all types and makes of boilers in a wide variety of plants both here and abroad.

A DOUBLE SAVING

The RotoStoker provides a double saving: Saves first—by increased efficiency. Saves again—because it will burn any kind of Bituminous Coal or Lignite. Users, therefore, buy their coal at *best price advantage*.

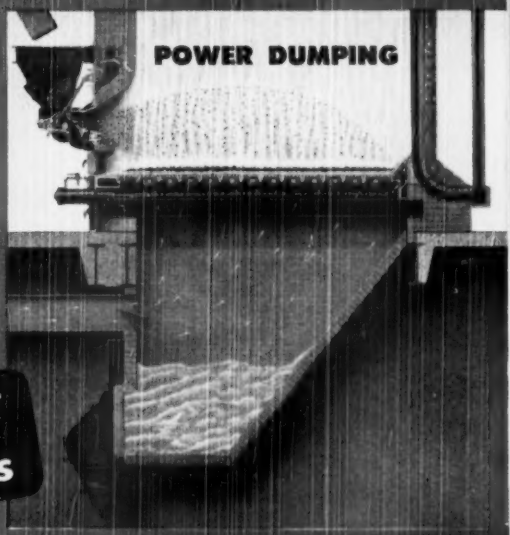
RotoStoker burning rates are higher and will provide you with more capacity. The ability to handle fluctuating loads has made it popular.

The Detroit RotoStoker has distinct advantages over other methods of firing.

As stoker designers and builders of fuel burning equipment exclusively, we recommend in each case the method of firing best suited to your plant and the fuel available.

STATIONARY GRATE—The Stationary Grate RotoStoker is usually applied to small and medium boilers where no hand-firing for unit loadings is provided.

HAND DUMPING GRATE TYPE—With the Hand Dumping RotoStoker, a shallow ash pit, as shown, is often sufficient. Ashes are discharged by releasing dumping levers and received through the ash doors at the front when necessary.



POWER DUMPING GRATE—*Steam Cylinders provide power for dumping. Each grate section is dumped independently of the others. Balance of the stoker carries the load with uniform steam pressure.*

OTHER TYPES AND SIZES OF DETROIT STOKERS FOR EVERY INDUSTRIAL NEED

DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

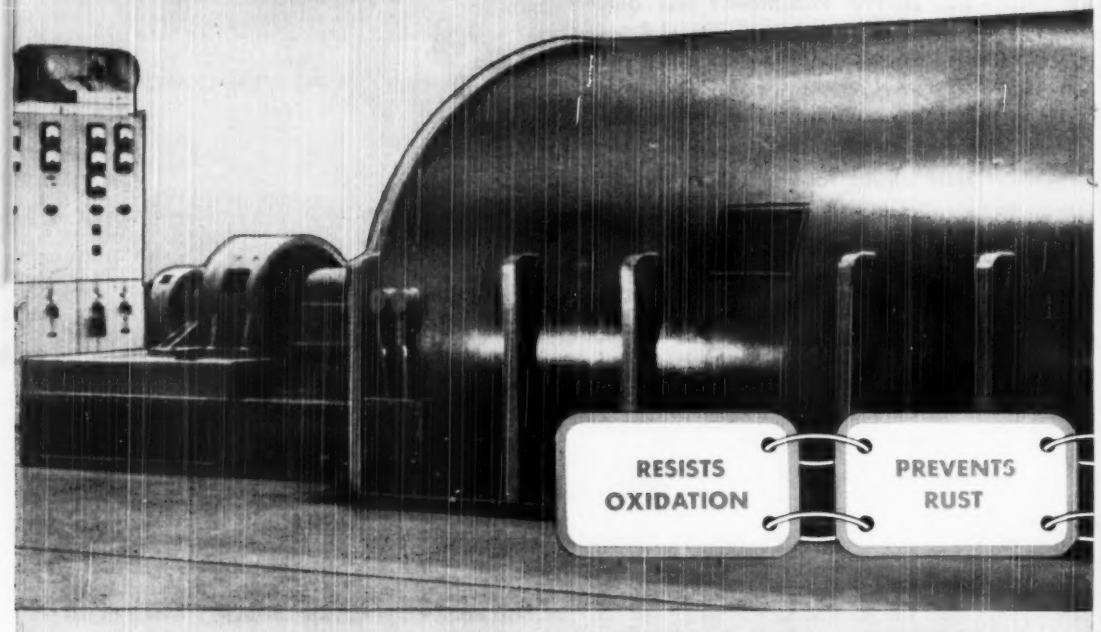
Works at Monroe, Michigan: District Offices in Principal Cities

A turbine oil

SINCLAIR

Cats seem to live a charmed life. And in many ways so do Sinclair SINTURLITE Oils! You'd expect the grueling conditions of turbine service to cut short the life of any oil. But SINTURLITE is different!

Not just for months—but for years—SINTURLITE keeps right on lubricating efficiently . . . resisting oxidation, retarding sludge formation, preventing rust, separating readily from water. Long serv-



For lubrication counsel, see your nearest Supplier of Sinclair Products or write to Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

SINCLAIR

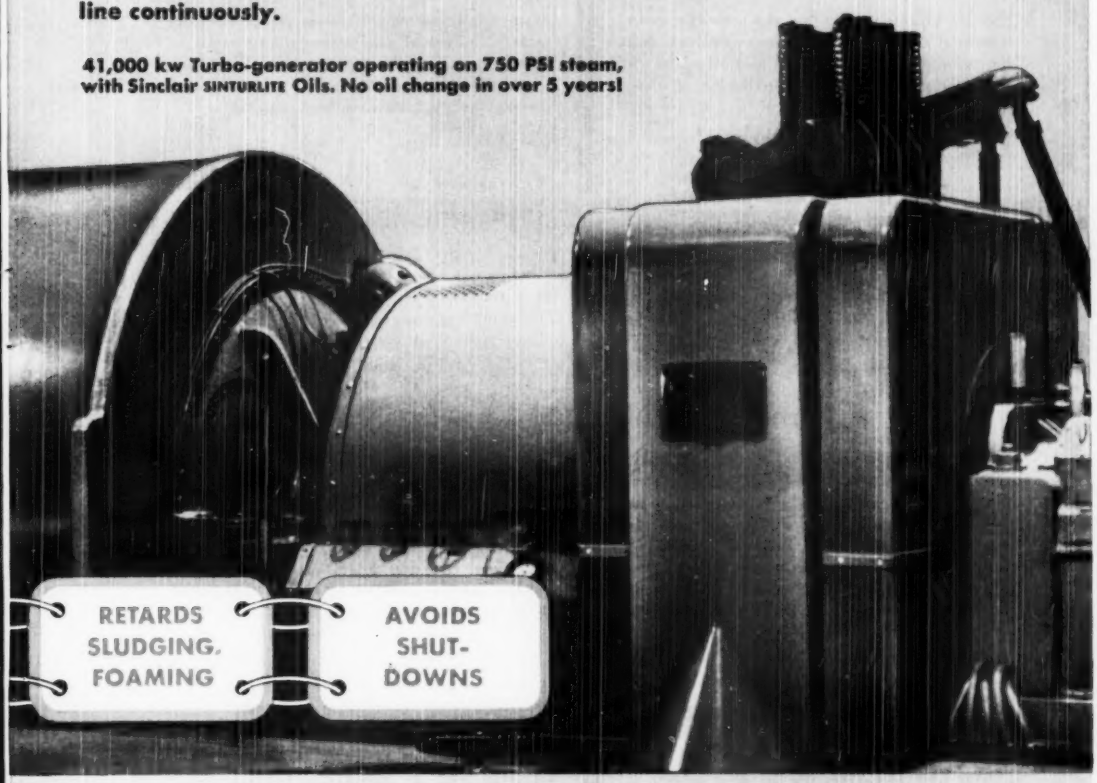
with nine lives...

SINTURLITE

ice life is assured by the superbly refined petroleum base and proven additives that are combined in SINTURLITE.

Avoid shutdowns—let SINTURLITE Oils keep your turbines on the line continuously.

41,000 kw Turbo-generator operating on 750 PSI steam, with Sinclair SINTURLITE Oils. No oil change in over 5 years!



INDUSTRIAL OILS

See NEW CONCEPTS

MULTIPLE POINT RECORDER

Provides multiple record of variables with separately adjustable alarm contacts, available for visual or audible signalling. One instrument performs functions of several.

PRECISION INDICATOR

"Push button" readings of remote temperatures provide instant reading of any 48 points on instrument. Auxiliary push button panel increases the number of remote readings possible.

PNEUMATIC TRANSMISSION SYSTEM

System utilizes transmitter and recording or indicating receiver; eliminates dangerous high pressure piping; affords safe, centralized instrumentation with accurate reproduction of measured variable.

LOAD DEVIATION RECORDER

Maintains a continuous check on base load deviation of individual generators, plant output or system deviation. Recorder has 2-second high speed pen travel; provides highly accurate measurement with fast response and recording.

SAFE TELEMETERING OF PRESSURES

The Brown Circular Chart *ElectroniK* and Microsen Transmitter form an accurate and safe system of transmitting pressures electrically. With Strip Chart Recorder, up to 16 pressure records are possible on one chart.

THERMOMETER WITH *ELECTR-O-VANE* CONTROL

Controller has snap action control with an extremely small dead zone. Few moving parts reduce wear and unit construction simplifies maintenance. Available in several different thermal systems, depending upon application.

STRIP CHART FREQUENCY METER

Just "plug in" to the nearest outlet for an accurate record of line frequency; assures continuous, accurate record of frequency deviations. This advanced instrument features all of the inherent advantages of the *ElectroniK* Potentiometer.

DISSOLVED SOLIDS IN FEED WATER

Conductivity Meter provides continuous record and visible indication of boiler feed water and steam purity. Warns immediately of condenser leakage. Highly sensitive to minute changes of dissolved solids in condensate.

WATTMETER

Accurate record of power generated, consumed or interchanged; sensitive to slight load changes; measures in watts, kilowatts or megawatts. Converts to Var Meter by adding auto transformer.

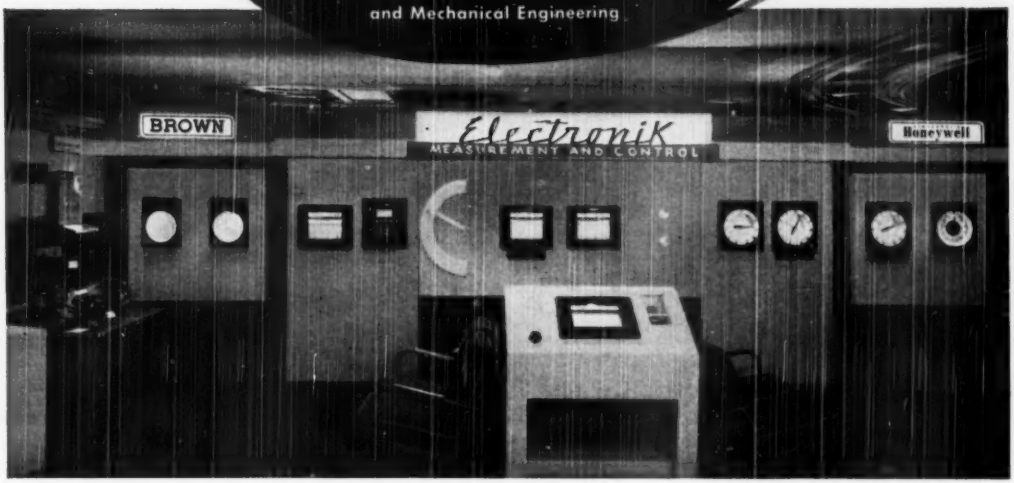
HONEYWELL VALVES

Complete line of industrial control valves for both wide and narrow band proportional control. Diaphragm motor operators and springless air motors; hand control valves.

OF INSTRUMENTATION

AT BOOTHS
30 and 31

19th National Exposition of Power
and Mechanical Engineering



BE SURE to stop at Booths 30 and 31 when you visit the Power Show in New York . . . you'll see the most modern *ElectroniK* Instruments available for power plant and central station operation. A whole new concept of instrumentation will be displayed . . . in operation.

This advanced instrumentation is the *modern* approach to efficient power generation . . . assuring unmatched speed, accuracy and dependability for measuring, recording or controlling all critical operating variables.

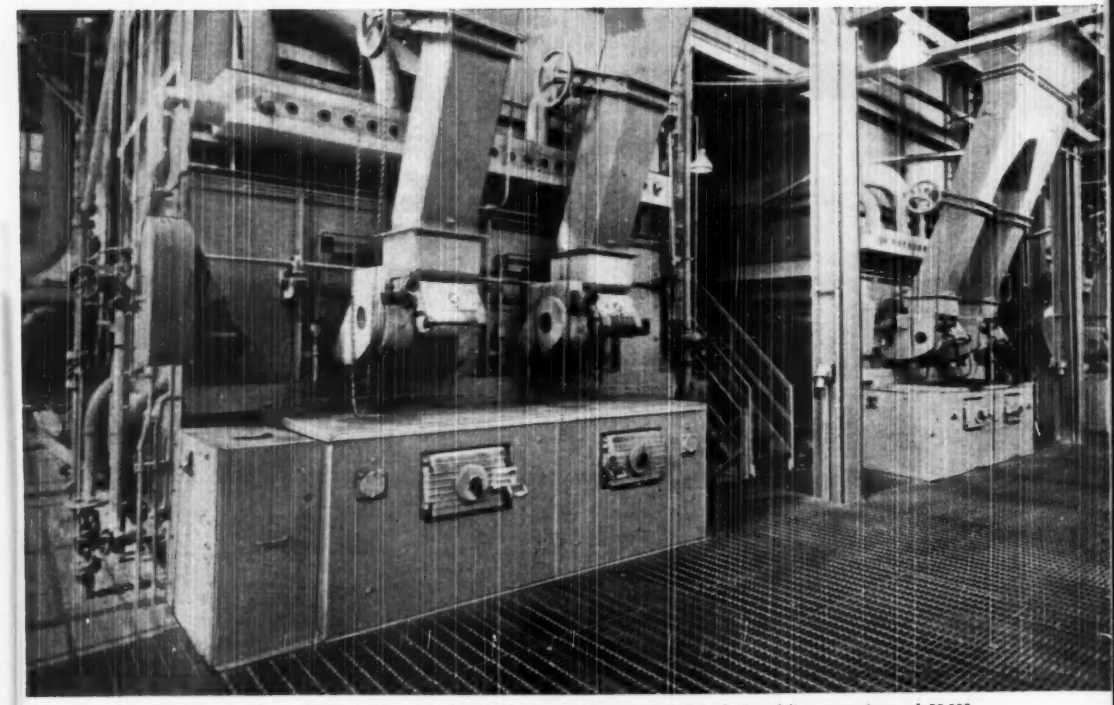
If you are unable to visit the Power Show, you can learn all about these NEW instruments from your local Honeywell engineer. Call him today . . . he is as near as your phone!

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

YOU'LL SAVE MONEY WITH A SPREADER

YOU'LL SAVE EVEN MORE WITH A . . .



Three 9' x 15'3" traveling grate Perfect Spread Stokers installed under Erie City Bent Tube boilers deliver a maximum of 55,000 lbs. per hour at a well-known chemical plant in Missouri. Sverdrup & Parcel, Inc., St. Louis, were the Consulting Engineers.

Only Perfect Spread Stoker assures even coal distribution . . . won't clog on wet coal . . . has a cinder return system that works . . . adjustable overfire air

THERE'S NO GUESSWORK about it. You'll save real money – important sums regularly – with a spreader stoker. It enables you to burn a wide range of coals, including the cheaper, high ash coals, with top efficiency. No more paying premiums for coal when you have a spreader stoker. You utilize the coals that are attractively priced in your locality.

IN SPREADER STOKERS—IT'S PERFECT SPREAD —FOR MOST STEAM AT LEAST COST

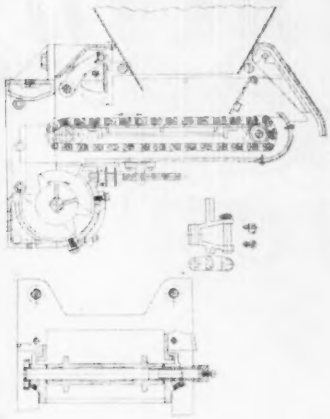
Exclusive features, unique in design, make the Perfect Spread Stoker the most efficient spreader that has ever been built. First and foremost, its feeder assures positive, continuous and accurate coal feed . . . it won't clog even when coal is wet. Next, the spiral overthrow rotor is unmatched for *even* coal distribution. And the engineered cinder reinjection and adjustable overfire air system are final assurance of superior fuel combustion.

Perfect Spread Stokers are made in both continuous discharge, dumping and stationary grate types. Coal feed is adjustable from 50 lbs. to 7,500 lbs. of coal an hour per feeder. Capacities range from 8,000 to 500,000 lbs. of steam per hour. Mail coupon on next page for full information . . . and be sure to call in your Consulting Engineer for recommendations regarding your requirements.

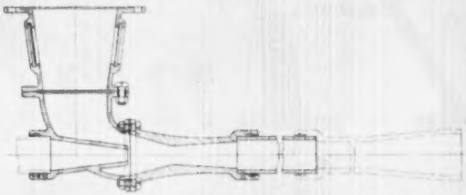
STOKER *BUT* . . . .

PERFECT SPREAD STOKER

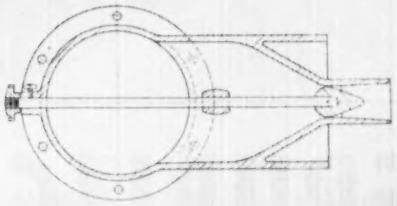
AMERICAN
ENGINEERING COMPANY



NON-CLOGGING CONVEYOR FEEDER: Coal enters feeder from hopper, and is conveyed positively, continuously and uniformly forward. Coal is not fed in slugs.



ENGINEERED CINDER REINJECTION SYSTEM: An extremely efficient system; all fittings of alloy iron. Air driven through the venturi section sucks cinders into the air stream for return to the furnace. A *separate* line is provided for each cinder drain point.

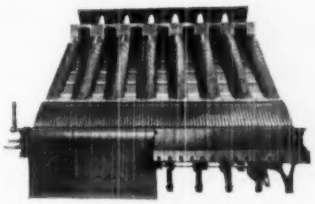


ADJUSTABLE OVERFIRE AIR SYSTEM: Most of the overfire air enters furnace through nozzles in side or rear walls. Each nozzle is a separate venturi-type unit and *individually* adjustable.

WHERE UNDERFEED STOKERS ARE INDICATED YOU CAN'T BEAT THE TAYLOR STOKER

Taylor Underfeed Stokers of adequate grate area deliver over 90% of the ash to the ashpit . . . and most of the remainder is collected in boiler passes without expensive dust recovery equipment.

Shown at right is a 7-Retort, 25 Tuyere Taylor Stoker. It provides low-cost steam for plants of moderate size. The principles of combustion are identical with those of the high capacity Taylor Stokers that are the standard for central stations and large industrial plants.



AMERICAN ENGINEERING
COMPANY
PHILADELPHIA 25, PENNA.

Other AE Products are Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Car Shakers, Car Pullers.

American Engineering Company
2400 Aramingo Ave., Philadelphia 25, Pa.

Gentlemen: We are interested in "most steam at least cost." Send me full information about ___ Perfect Spread Stokers; ___ Taylor Stokers.

Name _____ Title _____

Company _____

Address _____

City _____ Zone ___ State _____

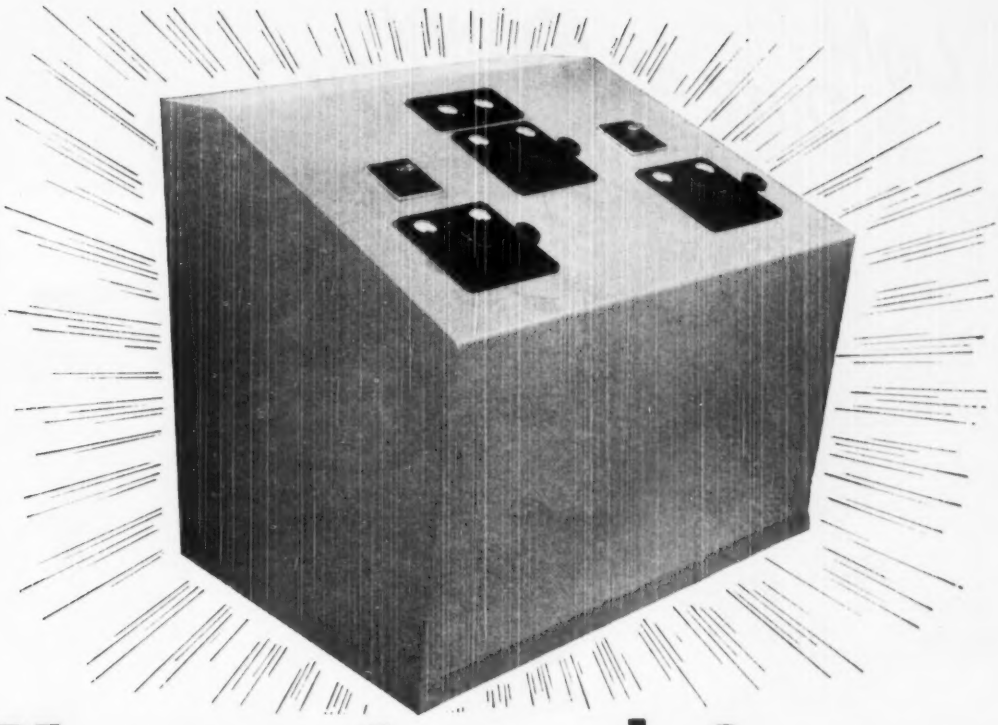
Announcing the new

REPUBLIC Electronic

See It!
Operate It!

VISIT BOOTH NO. 6
NEW YORK
POWER EXPOSITION
NOVEMBER 27 – DECEMBER 2

You are cordially invited to visit Booth No. 6 to see—to operate—to inspect the new Electronic TELEMASTER Control which will be on view for the first time. Our engineers will be available to explain its many unusual features. The complete line of Republic instruments and controls will also be included in the exhibit.



Master Control System

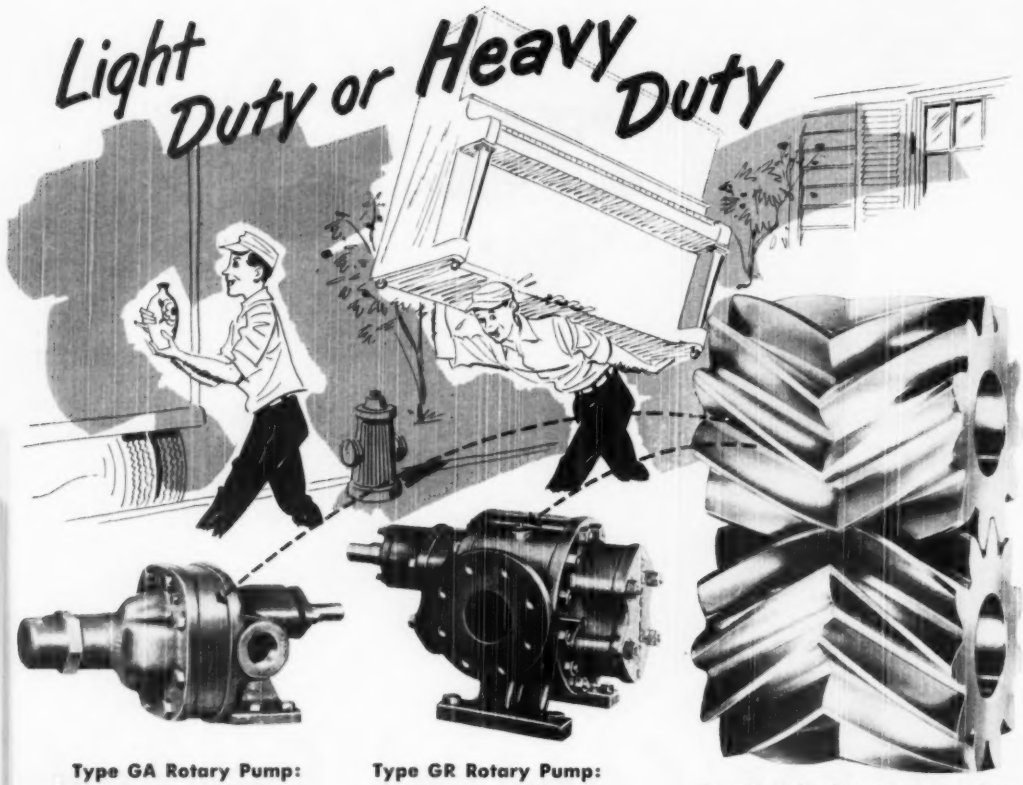
"TELEMASTER"

The new Republic Electronic TELEMASTER Control represents a major advance in the field of automatic control. The TELEMASTER will remotely reproduce, instantly and accurately, a position or a force—perform arithmetical and algebraic calculations—and can be used for multiple operations. Essentially it performs the function of a mechanical link through electrical and electronic means. It is applicable to all types of combustion and process control.

In plants where distances between operating units are great, the lags inherent in the compression effect of a pneumatic master system are appreciable. This effect is frequently sufficient to prevent realization of the full benefits of automatic control. The Republic Electronic TELEMASTER Control has no inherent lag, regardless of distance. This means that centralization of operations can be achieved without any sacrifice of control performance. *Full details sent upon request.*

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

Light Duty or Heavy Duty



Type GA Rotary Pump: Up to 50 gpm and 100 psi.

Type GR Rotary Pump: Up to 5000 gpm and 500 psi.

Double Helical Herringbone Gear Rotors: Quiet and efficient; extra large wearing surfaces; no axial thrust; no trapping of liquid.

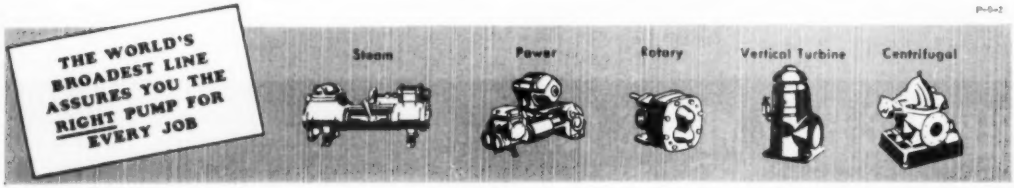
. . . You Get The Same Sturdy Construction!

For light duty pumping of hot or cold, thin or viscous liquids, use the Type GA . . . for heavy duty, hook up its big brother, the Type GR. Either way you're sure of the ruggedest construction and smoothest performance it's possible to build into a rotary pump. That's because both these hard working huskies incorporate the special herringbone rotors that operate so quietly and efficiently . . . combining with the whole advanced Worthington design for long, trouble-free, money-saving service. Get the whole story that proves *there's more worth in Worthington.* Write, describing your requirements to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.*

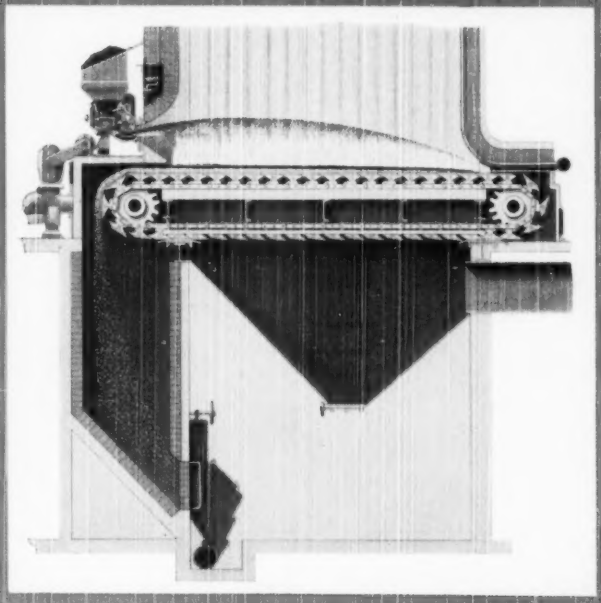
WORTHINGTON

P-6-2

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



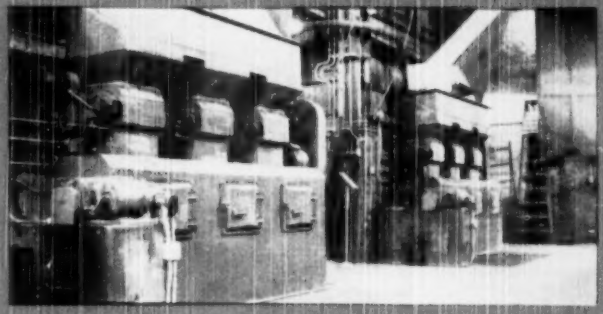
HOFFMAN INDUSTRIAL STOKERS



Hoffman C-A-D grates may be installed to discharge to either front or rear, as local conditions and final ash disposal requires.

Capacities from 30,000 to 250,000 pounds of steam per hour are available under a wide range of steam conditions and coal analysis.

Any Hoffman C-A-D stoker installation may be changed from using low ash to very high ash coals by one manual adjustment of the moving grate gear ratio.

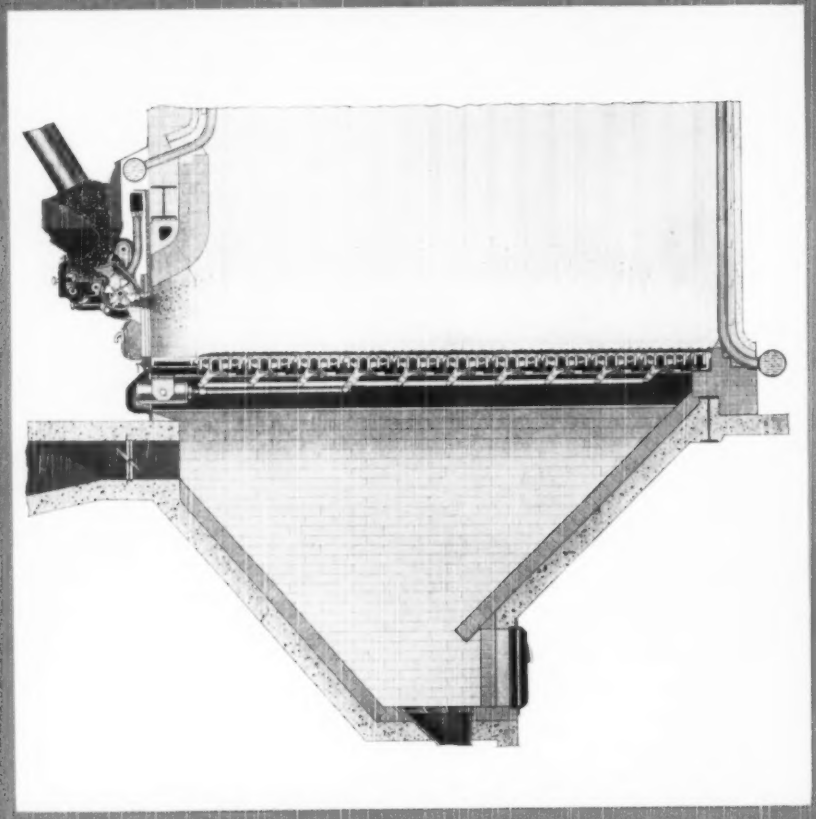


HOFFMAN COMBUSTION ENGINEERING COMPANY

Operating Features of Firite Stokers

High Rating with Any Kind of Coal

Many exclusive design features developed as a result of years of field experience, make it possible for Hoffman stokers to operate at high ratings and high furnace temperatures and with extremely low maintenance, when burning any kind of coal, anywhere, in the smaller and cheaper sizes with no preparation cost—as received—wet or dry.



Let us send you a list of references in your neighborhood, or in your industry. See the stoker work, observe the load, type and size of coal used, ask the operator and the owner.

INVESTIGATE BEFORE YOU BUY

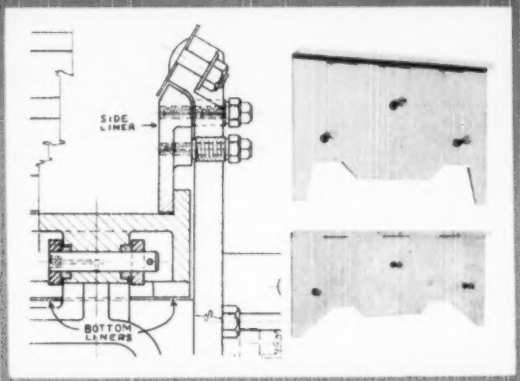
A Hoffman stoker is a life-time investment, if given reasonable care and operated in accordance with written instructions.

HOFFMAN COMBUSTION

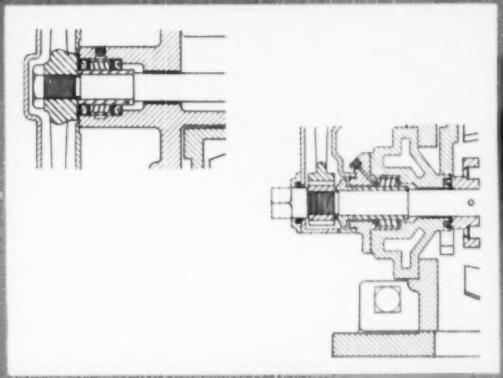
PLUS VALUES by HOFFMAN

Exclusive features incorporated in all Hoffman Stokers, for Lower Maintenance, Higher Efficiency and general overall satisfaction by owners and operators.

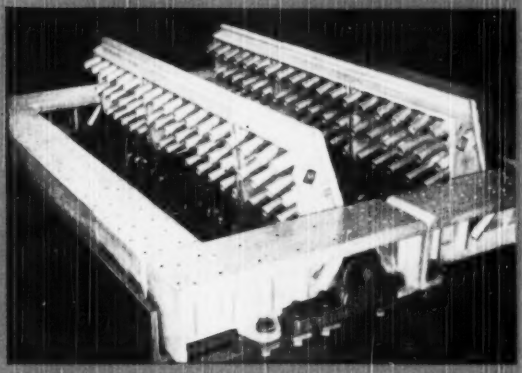
NO EXTRA COST



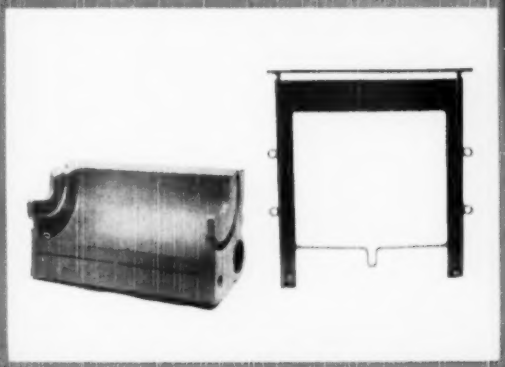
Patented replaceable liners on interior wearing surfaces, offering high resistance to abrasive action, insurance against major items of repair.



Patented water-cooled bearings on main impeller shaft, together with dust-sealed inner and outer races, offer full protection from radiant furnace temperature and from coal dust abrasion.



Patented tube-tuyere grates with uniform tuyere openings and large extended surface provide highest combustion efficiency and lowest potential maintenance.



Patented water-cooled gasket between each coal feeding unit and the furnace front protects the mechanism against the heat of conduction. An air-cooled, adjustable throat piece allows quick manual adjustment for varying coal sizes and varying surface moisture content.

ENGINEERING COMPANY

BOILERS EQUIPPED WITH HOFFMAN C-A-D STOKERS.

Babcock & Wilcox Company

Edge Moor Iron Works

Erie City Iron Works

Foster Wheeler Corporation

Heine Boiler Company

Puget Sound Machinery Co.

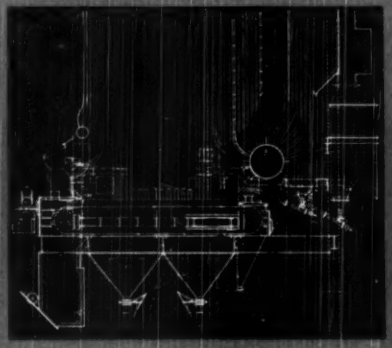
Riley Stoker Company

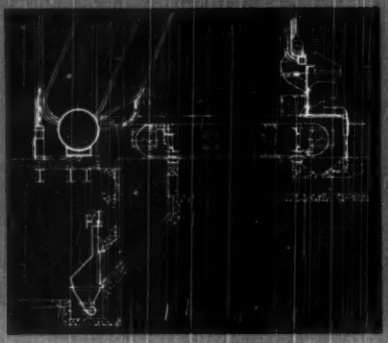
Springfield Boiler Company

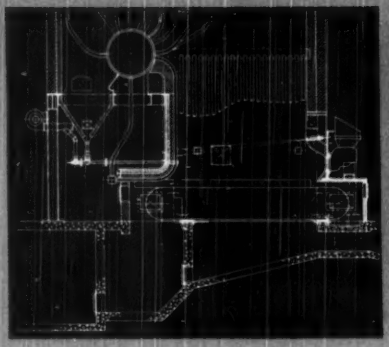
Union Iron Works Company

Henry Vogt Boiler Company

Wickes Boiler Company







THE FOLLOWING INDUSTRIES AND INSTITUTIONS SERVED BY HOFFMAN C-A-D STOKERS.

Army Air Base

Chemical Industries

Brewing Industry

Coal Mining

Drop Forging

Educational

Federal Power Utilities

Great Lakes Shipping

Harvesting Machinery Mfg.

Municipal Plants

Metal Working Plants

Materials Drying Plants

Plate Glass

Public Utilities

Paper Mills

Pharmaceutical Mfg.

Printing & Office Equipment

Portland Cement Mfg.

Paint Materials Processing

Rubber Industry

Railroad Shops

Textile Machinery Mfg.

HOFFMAN COMBUSTION ENGINEERING COMPANY

General Offices: MARQUETTE BUILDING, DETROIT 26, MICHIGAN

Works: FAIRMONT, W. VA. and DETROIT, MICHIGAN

11 YEARS on the Line

✓ No Maintenance
✓ No Downtime

THIS ROCKING CONTACT VOLTAGE REGULATOR has been on the line without downtime or maintenance since installed eleven years ago!" says Mr. Kudick, engineer-in-charge of the East Wells Street Power Station of the Wisconsin Power Company in Milwaukee. "This regulator was installed to hold down voltage peaks . . . it does the job. Performance has been excellent."

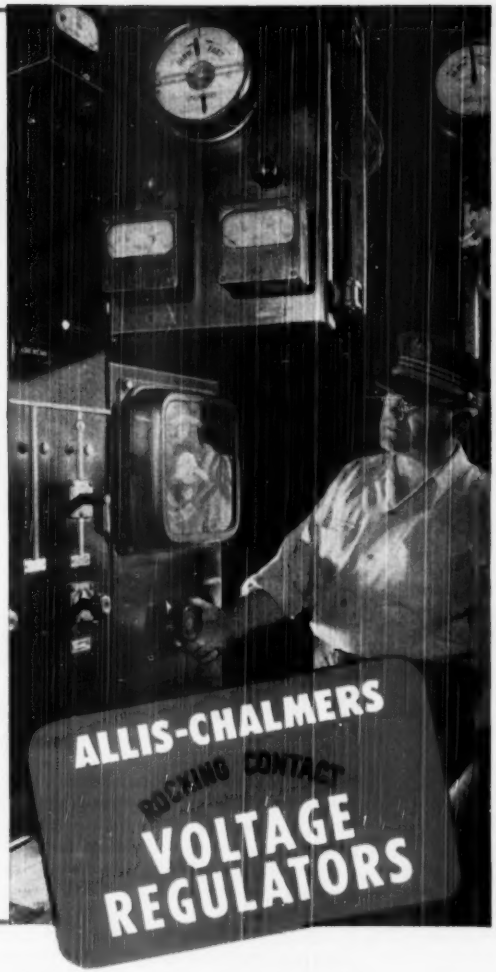
What are reasons behind this typical performance?

1. Allis-Chalmers Rocking Contact Generator Voltage Regulators have no vibrating contacts, no gliding friction, no complex adjustments. The few moving parts are all supported in jeweled bearings.
2. They are genuinely precision manufactured. Sectors rock on accurately machined commutator segments that are silver surfaced for positive contact, long life.

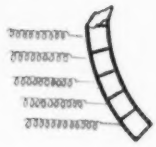
If you want long years of trouble-free service, specify *Rocking Contact* Generator Voltage Regulators for your next switchgear or switchboard . . . or replace inefficient regulation now! Call your nearby Allis-Chalmers representative or write direct for more information.

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

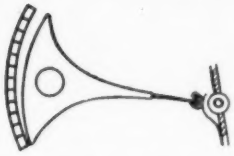
A-3148



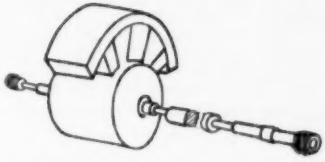
WHY POWER ENGINEERS IN UTILITIES AND INDUSTRY PREFER ALLIS-CHALMERS ROCKING CONTACT REGULATORS:



Each commutator segment is connected to a wire wound resistance element that is accurately designed according to the characteristics of *your* generating equipment. Resistance elements are air cooled —commutator is in dust-tight enclosure.



Rocking Contact sector pivots on jeweled bearing . . . has smooth working, hard graphite face that rocks on curved, silver surfaced commutator . . . regulates with slight movement . . . reduces wear . . . maintains accuracy.



Quick acting torque motor drives Rocking Contact Sector . . . has jeweled bearings for rapid, accurate, anti-friction movement. Aluminum rotor reduces inertia . . . increases speed of response.

ALLIS-CHALMERS

low-cost process heat

dependable low-speed power

GET BOTH with G-E

If your plant uses process steam, you may be able to improve over-all heat balance by driving low-speed equipment with General Electric geared turbines. Mechanical drive turbines act as reducing valves to drop boiler steam pressures down to utilization temperatures for process requirements. With turbines skimming off only a small portion of the steam's heat, mechanical power for driving fans, blowers, pumps and other low-speed apparatus is almost free.

Standard Type DP and DR turbines, combined with General Electric precision-type gears, are ideal for many such applications.

PRECISION GEARING

General Electric balanced-thrust gears are specifically designed for use with turbine drives. Smoothness and quietness of operation are the result of maintaining tooth contours and spacing to a high degree of accuracy.

Positive lubrication assures long life. Oil is delivered to the bearings from a gear-type pump driven by the pinion shaft. The gear mesh is spray-lubricated.

To meet a variety of application requirements, these gears are available in ratios from 1.5 to 10.3.

PRECISION GOVERNING

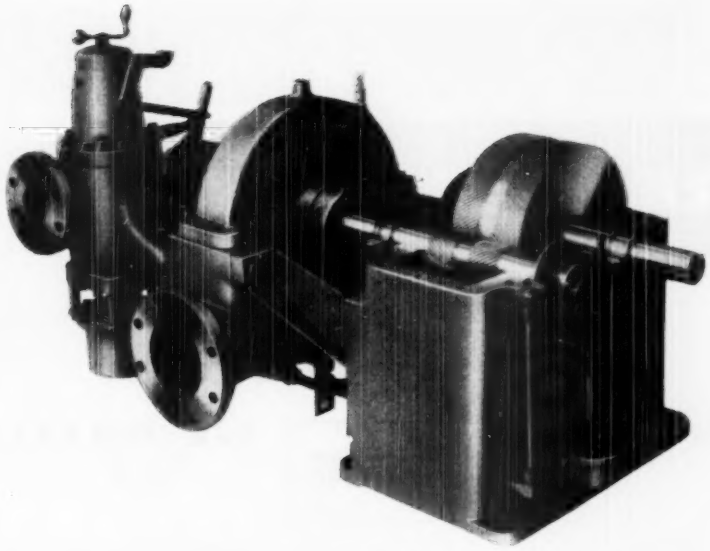
General Electric Type DP and DR turbines include extra features at no extra cost. The DP's hydraulic governing system provides a speed range of 30 per cent with 6 per cent regulation. The DR's oil-relayed governor offers speed ranges up to 5 to 1 with accuracy of ¼ of 1 per cent. Each turbine has its easily operated trip-throttle valve and governing valve combined in one compact unit. Rugged construction from quality materials makes these standard turbines outstanding for reliability and efficiency.

ONE INTEGRAL UNIT

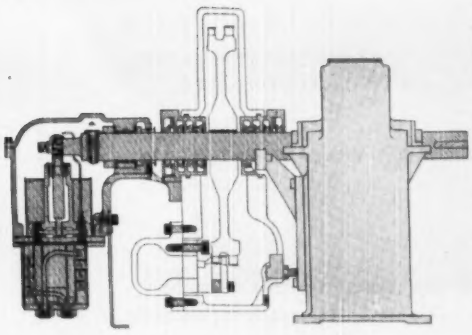
General Electric close-coupled turbine-gear sets have one common turbine and pinion shaft, with the turbine and gear casings solidly connected by a sturdy fabricated bracket. This construction results in a compact unit, does not require high-speed coupling.

Many standard parts are interchangeable with other turbine and turbine-gear drives.

Your nearby General Electric sales office will supply you with full details about mechanical-drive turbine-gear sets. Or, if you prefer, write for free copies of illustrated bulletins on these drives. The DP and DR turbines are described in bulletins GEA-4955 and GEA-5193. Bulletin GEA-5152 contains information about gears. Learn how installing these precision drives in your plant can save you money. Apparatus Department, General Electric Company, Schenectady 5, N. Y.



TURBINE-GEAR DRIVES



HERE'S WHAT STANDARDIZATION PROVIDES FOR YOU

This diagram shows how a standard DP turbine is close-coupled to a low-speed gear using an integral turbine and pinion shaft. All shaded turbine parts are interchangeable on all sizes of DP turbines. Thus, it is easy to stock spares, and maintenance costs are reduced. All individual turbine models and gear sets have standard shaft heights for easy installation or re-location in your plant. In addition, standardization cuts manufacturing expense, and the savings are passed on to you in the form of extra features usually found only on "special" turbine-gear drives.

GENERAL ELECTRIC

3 REASONS WHY

LEADING POWER COMPANIES CHOOSE Sturtevant E-R WHEELS

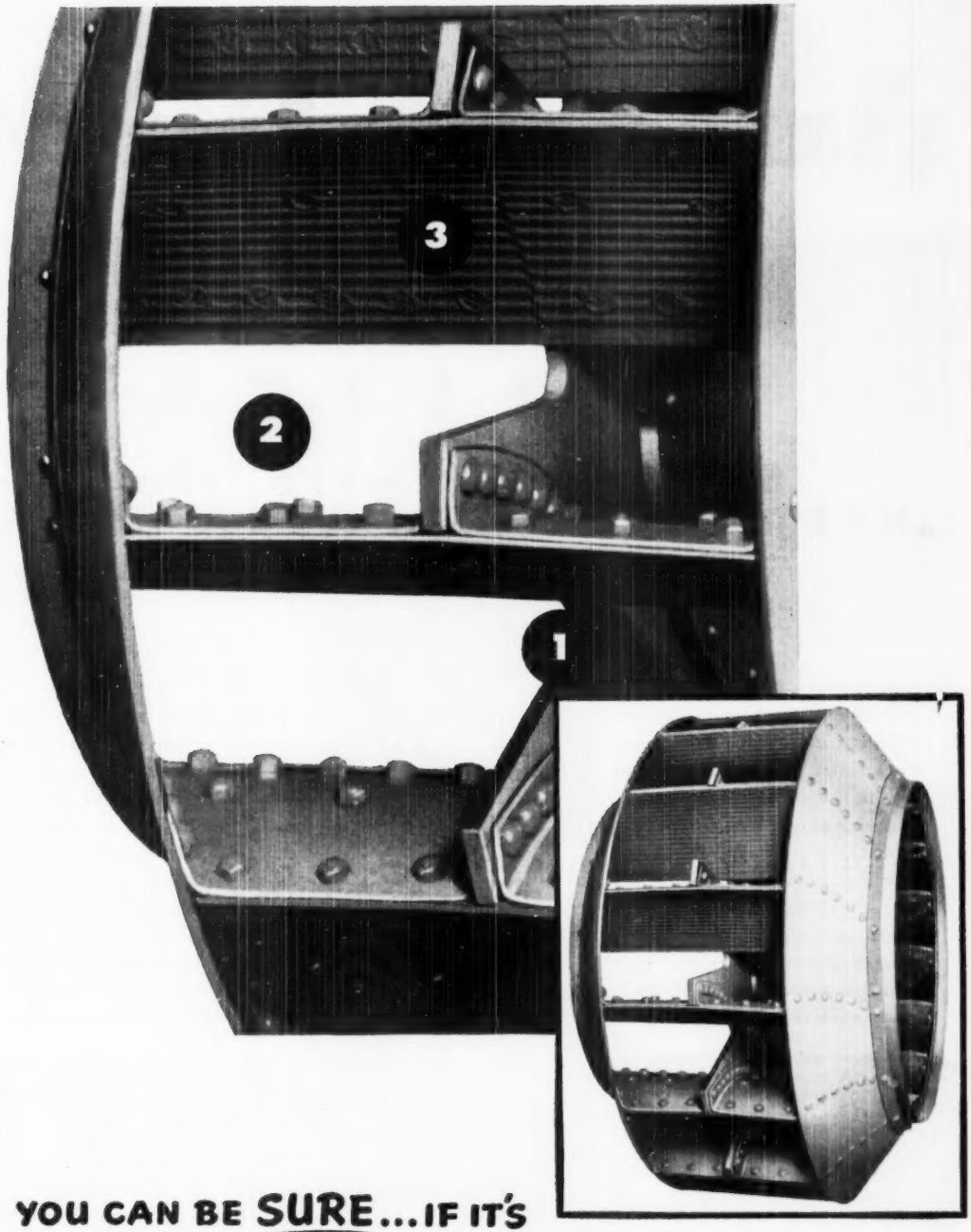
Many years of reliable, on-the-job service have built a reputation for sound, economical performance for the Sturtevant Erosion Resistant Wheel. The E-R Wheel, specially designed to resist fly-ash erosion, has proved in hundreds of installations that it gives *two to four times longer life* than standard wheels. Leading power companies and public utilities specify the E-R Wheel when investing in induced draft equipment. Here are three solid reasons why:

1. Erosion of the blade surfaces is sharply reduced by cutting away the center support plate. Streams of fly-ash meet—and dissipate their abrasive action *on each other* instead of on the wheel surfaces.

2. Fewer blades and the absence of tie rods mean less obstruction to the flow of fly-ash and less surface exposed to eroding action. This increases efficiency.

3. Ribbed blade liners are easily and quickly renewable, or can be welded locally when wear is concentrated. This reduces costly down time and greatly reduces maintenance costs.

For full information on the economies of the Sturtevant E-R Wheel, contact your nearest Sturtevant Office or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



YOU CAN BE SURE... IF IT'S

Westinghouse

J-80204A

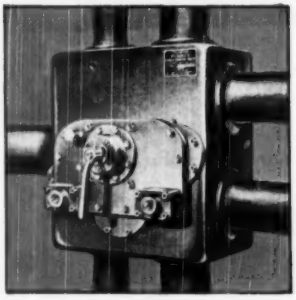
Automatic Wa

now available with

COCHRANE ZEOLITE

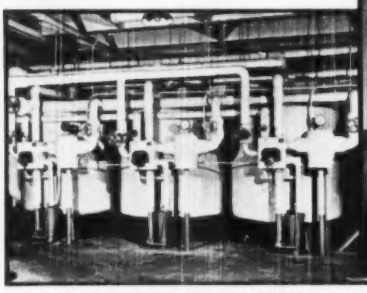
SOFTENER with the HYDROMATIC SINGLE CONTROL VALVE

AUTOMATIC water softening is now easily accomplished with the modern Cochrane Zeolite Softener equipped with the automatically controlled Hydromatic Valve. This remarkable valve combines, in a single pilot-actuated valve, the functions of six individual gate valves common to the customary "valve nest". For automatic control the valve is motorized and electrical controls, as shown on the opposite page, go into action. With a meter set to the degree of hardness of the water, regeneration is accomplished automatically and economically, with no further attention on the part of the operator.

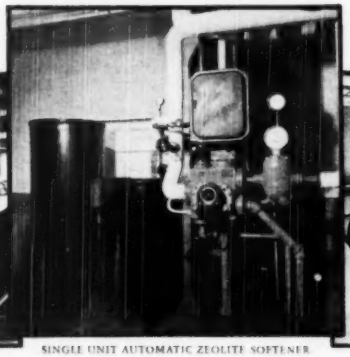


WIDE RANGE OF ZEOLITES AVAILABLE

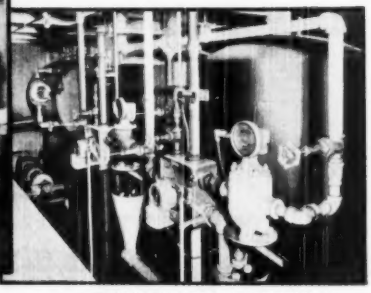
The Cochrane Automatic Zeolite Softener is adapted to any set of water conditions with zeolite material best suited to the raw water to be softened. Siliceous and Non-Siliceous Zeolites are available. The Siliceous include the low and high capacity greensands and the synthetic gels. The Non-Siliceous include the coal-base type and resins of the phenolic and styrene types. Cochrane service includes analysis and recommendation.



3-UNIT AUTOMATIC ZEOLITE SOFTENER

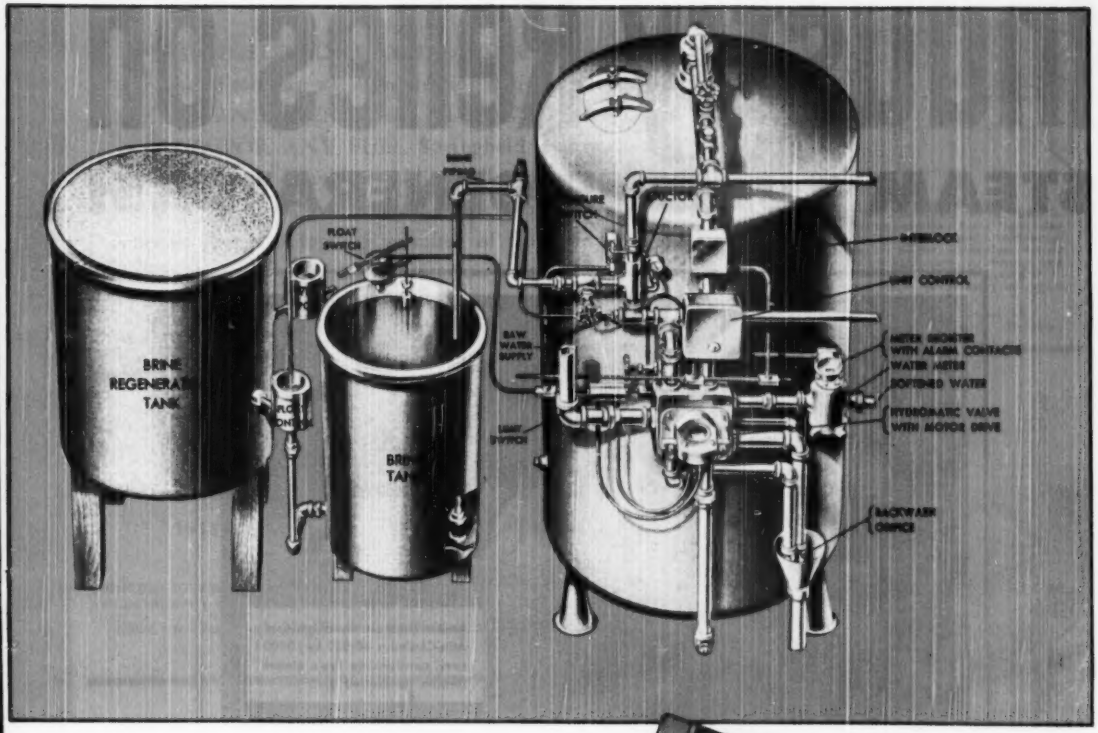


SINGLE UNIT AUTOMATIC ZEOLITE SOFTENER



2-UNIT AUTOMATIC ZEOLITE SOFTENER

ıter Softening



A new publication describing the zeolite process of water softening with detailed information and tables is just off the press. The coupon herewith will bring you a copy.

87 YEARS OF SERVICE

COCHRANE CORPORATION

PHILADELPHIA 32

In Canada: Canadian General Electric Co., Limited, Toronto
In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris

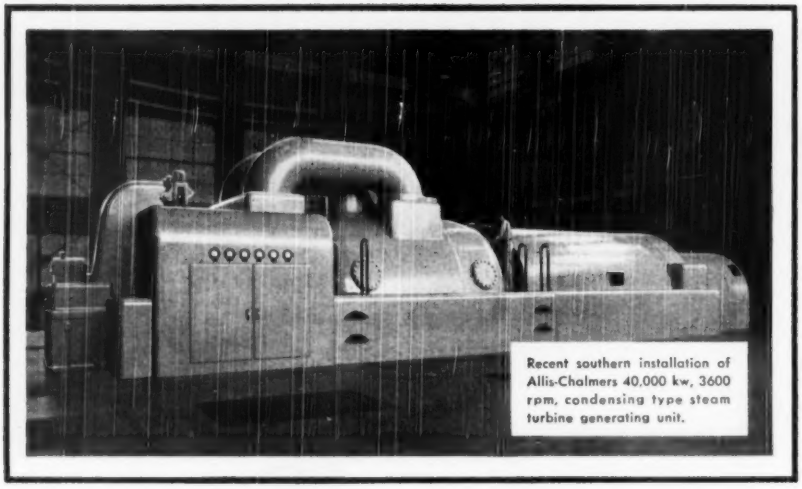
Cochrane Corporation
3106 N. 17th St., Philadelphia 32, Pa.

Please send a copy of your Publication No. 4250 on Cochrane Zeolite Softeners.

Name .....
Firm .....
Address .....
City ..... State .....

For Power Today, Industry Relies on

STEAM TURBINE GENERATORS!



Recent southern installation of Allis-Chalmers 40,000 kw, 3600 rpm, condensing type steam turbine generating unit.

SOME CALL THIS THE ATOMIC AGE, but steam is more than ever the prime mover in American industry. Steam, driving the modern steam turbine and generator, now supplies over 70 percent of U. S. electric power!

And every year sees more steam turbines going on the line . . . turbines with design still further perfected, operating more efficiently and for longer periods between shutdowns. At Allis-Chalmers, turbine design is progressive, with advances in materials and know-how immediately being translated into better machines.

As a manufacturer building large central station turbine generator equipment, A-C is an important source of steam turbines in all types and combinations. In the larger ratings, A-C has in service large single shaft condensing units to 150,000 kw and topping turbines to 50,000 kw.

In addition to concentrating on mechanical features, Allis-Chalmers builds steam turbine generators with an eye to functional and attractive appearance (see photo above).

When you plan the installation or expansion of a steam power plant, consider Allis-Chalmers. Put its 80 years of steam power experience to work for you. Offices in all major cities. A-3213

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANS-FORMERS | WATER CONDITIONING

World's Widest Range of Power Plant Equipment

MODERN STEAM GENERATING UNITS

. . . any size . . . any pressure . . .
any temperature . . . and for any fuel

SPRINGFIELD BOILER CO. specializes in the production of modern steam generating equipment . . . ANY SIZE . . . ANY PRESSURE . . . ANY TEMPERATURE . . . AND FOR ANY FUEL. Springfield is organized to apply the same *engineering skill* to all contracts, large or small. This is one of the reasons why Springfield is the choice of an increasing number of power engineers interested in having careful attention given to their jobs. Springfield service includes design, fabrication, erection and placing in operation of the complete unit. We will be glad to submit a proposal covering your requirements.

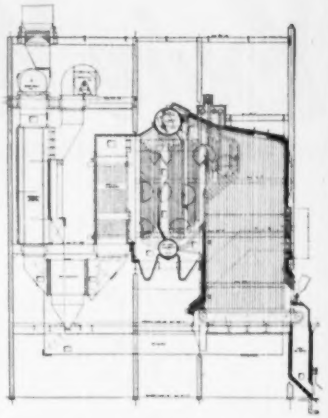
SPRINGFIELD BOILER CO.

1953 E. Capitol Ave. • Springfield, Illinois, U.S.A.

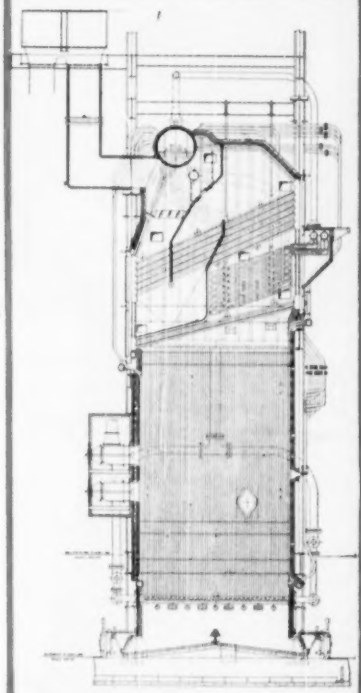
Worldwide Sales and Service

BENT TUBE BOILERS • STRAIGHT TUBE BOILERS • SUPERHEATERS • DESUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATERWALLS • PACKAGE BOILERS • COMPLETE STEAM GENERATING UNITS

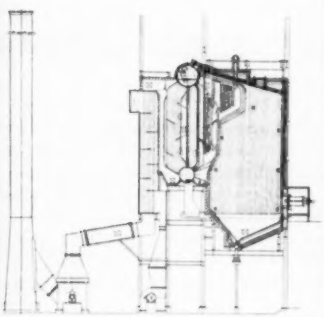
Check with your Consulting Engineer on Modernization and New Plant Projects



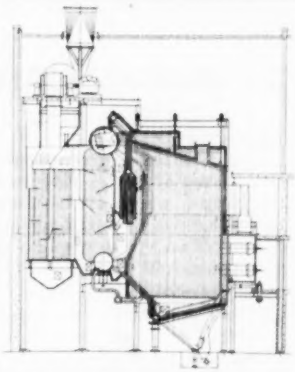
ELK RIVER STEAM PLANT, ELK RIVER, MINN. — 120,000 lb. Springfield two drum, bent tube steam generator (2 units) complete with water cooled furnace, air heater, economizer, forced and induced draft equipment, instruments and controls. Operating pressure, 615 p.s.i. 830° F. controlled total steam temperature at superheater outlet.
Ralph D. Thomas and Associates, Inc.
Consulting Engineers, Minneapolis, Minnesota



IOWA ELECTRIC LIGHT & POWER CO., CEDAR RAPIDS, IOWA — 300,000 lb. Springfield installation (4 units). This design features Springfield's exclusive center water wall (divided furnace) type of construction. 750 p.s.i. design pressure, 750° F. total steam temperature at superheater outlet at 700 p.s.i. operating pressure with pulverized coal firing.



CHARTER OAK STEAM PLANT, BELTON, TEXAS — A modern, two drum 130,000 lb. Springfield steam generator (2 units) complete with water cooled furnace, superheater, air heater, forced and induced draft equipment. 630 p.s.i. pressure. 825° F. total steam temperature at superheater outlet. Firing with gas and oil.
Laramore & Douglass, Inc. Consulting Engineers, Chicago, Illinois



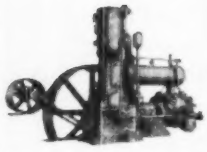
CITY OF COLORADO SPRINGS, COLO — A 150,000 lb. Springfield bent tube, two drum steam generator complete with water cooled furnace, superheater, air heater, forced and induced draft equipment. 410 p.s.i. pressure. 750° F. total steam temperature at superheater outlet. Gas or oil firing with future provision for pulverized coal.
Lutz & May, Consulting Engineers,
Kansas City, Missouri

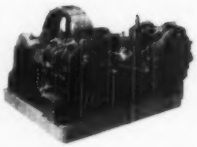
SEE OUR CATALOG IN SWEETS

You're Years Ahead with a

THE LARGE
JOY ANGLE
OF 1930

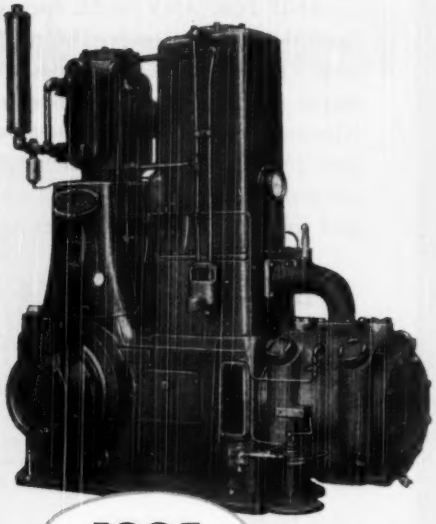
JOY ANGLE COMPOUND
1913
THE FIRST ANGLE
OR L DESIGN



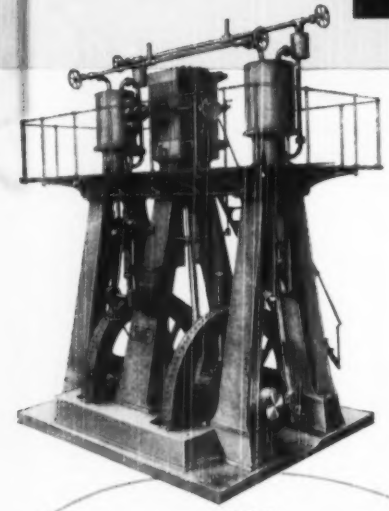


1905
THE JOY CROSS COMPOUND

TYPICAL JOY
ANGLE OR
L DESIGN OF
25 YEARS AGO
(FIRST "PACKAGE" TYPE)



1925



1885
TYPICAL JOY VERTICAL
OF 65 YEARS AGO

DESIGN–PIONEERS OF THE INDUSTRY

These seven Joy compressor illustrations and their dates tell a story of design leadership in the compression of air and gases. Here, we believe, is visual proof of the part Joy has played in the progressive development of compressor design and construction.

We are justly proud of this heritage and what it means. The design of our WN-112 and WN-114 is years ahead of the field, offering greater economies and higher efficiencies to the modern user of air power. We know because we have designed and built them all.

W&D-3242

Consult a Joy Engineer

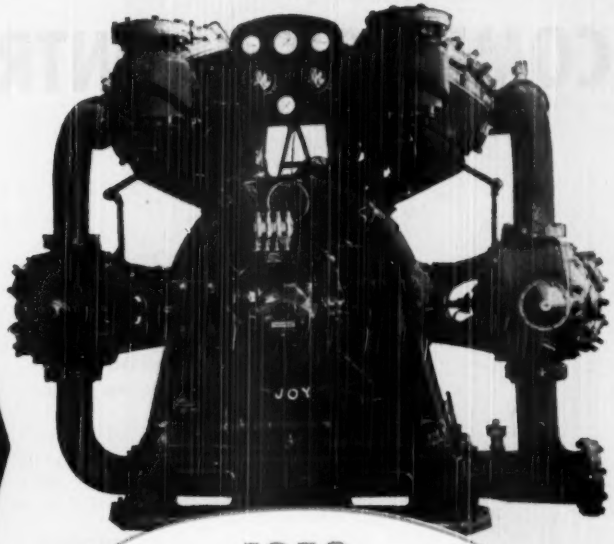
JOY COMPRESSOR

1936
JOY V VERTICAL
THE FIRST OF THE
PRESENT DAY
MODERN TYPE
COMPRESSORS

Compare

the inherent advantages of the old and the new in AIR COMPRESSORS —and insist on these advantages in <u>your</u> COMPRESSED AIR PLANT

● **Let us quote on your requirements**



1950
JOY WN-114

Compare these QUALITY CONSTRUCTION FEATURES

REPLACEABLE CYLINDER LINERS
These satin finished liners assure uniform cylinder walls for efficient heat transfer and eliminate cylinder reboring.

REPLACEABLE CROSSHEAD GUIDES
Honed "mirror-finished" wearing surfaces eliminate periodic crosshead adjustment.

BEARINGS WITH "ROLLING SURFACES"
Anti-friction, spherical roller bearings eliminate wear and need for adjustment inherent in sleeve-type bearings.

HEAVY-DUTY INTERCOOLER
Easily cleaned when necessary—insures maximum cooling for greater compressor efficiency.

LOW HEIGHT
(7 feet 7 inches) eliminates all head-room troubles when servicing or inspecting.

FORCE-FEED LUBRICATION
Use of bronze-screen, replaceable filter unit supplies clean, dirt-free oil to all bearing surfaces.

DIRECT, STREAMLINED AIR PASSAGES
Streamlined air passages with direct connection of intercooler and cylinders give maximum efficiency and minimum piping problems.

DUAL-CUSHION ANGLED VALVES
These valves, in combination with truncated pistons, give minimum valve clearance and maximum compressor efficiency.

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

what *results*

do you want from your

COMBUSTION CONTROL SYSTEM ?

Of course you want the best results you can get. But, more particularly, you want *specific results to solve your combustion problems.*

Hays engineers "focus" on your problems. They have the experience in planning combustion control systems to give you specific results like:

- smoke abatement
- reduced boiler room labor costs
- decreased outage
- constant steam pressure
- lower fuel bills by means of switching fuels
- increased boiler capacity
- firing mixed fuels efficiently
- rapid response to steam demand

Such specific results are described in the published "Case Histories" listed at the right. Here's how you can get them—

HOW TO GET RESULTS

Send a brief statement of your combustion problem and the results you want to Orval W. Riggs, Manager, Application Engineering, The Hays Corporation, Michigan City (3), Indiana. In return, you will receive:

1. Our preliminary recommendations for a solution to *your* problem.
2. A 48-page booklet on the various Hays control systems and how they work.
3. The five "Case Histories" giving details of Hays control, "getting results" on five different problems at leading companies throughout the country.

HAYS COMBUSTION CONTROL

Low maintenance?

"we find that due to the (Hays) properly controlled combustion, our maintenance on both stokers and boilers has been considerably decreased."

American Tobacco Company
Bulletin—AT

Good CO_2?

"CO_2 readings show that on an average day our CO_2 varies between 13% and 14% despite load fluctuations."

Sunshine Biscuits, Inc.
Bulletin—SB

Increased efficiency?

"Operating efficiency has been as high as 82%—much of the credit going to the accuracy of (Hays) automatically controlled combustion."

Sherwin Williams, Chicago Plant
Bulletin—SW

Fuel savings?

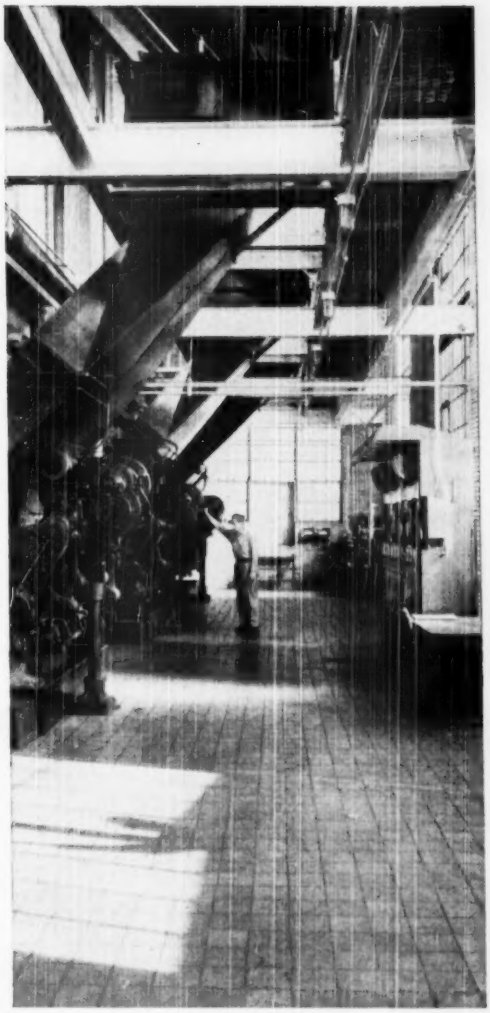
"we estimated that...we would be able to pay for the new equipment (Hays Combustion Control) out of fuel savings in three years. Since then, the records show that the amortization of the original investment has been accelerated."

Raybestos—Manhattan, Inc.
Bulletin—RM

Rapid response to wide load swings?

"we have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs per hour with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%."

Bemis Brothers Bag Company
Bulletin—BB



Bulletin—AT

Bulletin—SB

Bulletin—SW

Bulletin—RM

Bulletin—BB

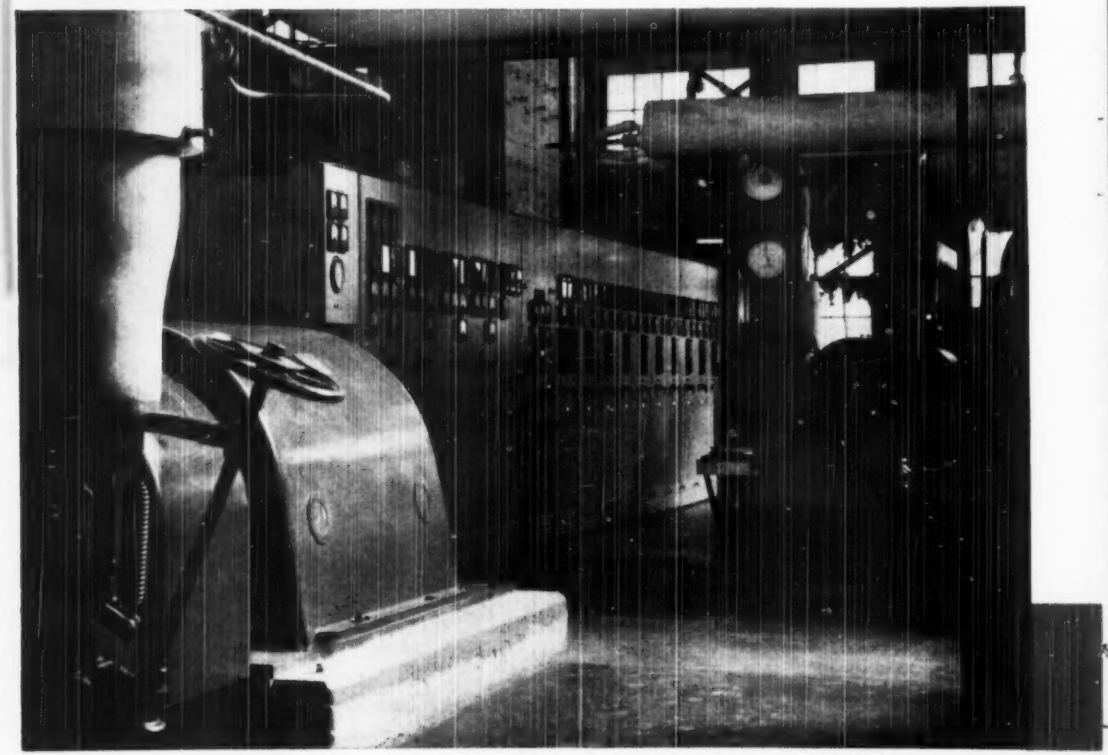
THE **HAYS** CORPORATION *MICHIGAN CITY 3, INDIANA* • Automatic Combustion Control

Boiler Panels • Hays-Penn "Towmeters" • VariFlow Meters and Varitrol Gas Analyzers • Draft Gages • Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

FREEPORT SULPHUR EXPANDS

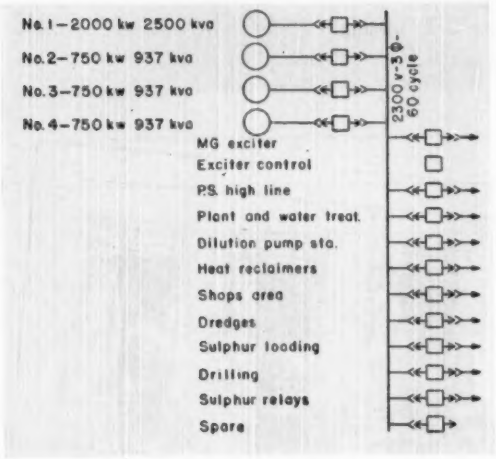
This inadequate, open-type switchgear was replaced by the new G-E Metal-clad equipment shown below. Freeport Sulphur officials recognized that the old switchgear had outgrown its usefulness.

Here's the new General Electric 5-kv Metal-clad switchgear installed at Freeport Sulphur. Magne-blast power circuit breakers have plenty of "IC" (Interrupting Capacity) to handle all short circuits that may occur on Freeport's expanded distribution system. This assures continuous power for vital production.



AND MODERNIZES WITH

METAL CLAD SWITCHGEAR



This one-line diagram shows power distribution at Freeport Sulphur as planned by Sargent and Lundy, consulting engineers of Chicago. General Electric Metal-clad switchgear handles the 2300-volt power from the generators through power circuit breakers of 100,000-kva interrupting rating.

The Freeport installation is a complete General Electric project—one source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

Be sure to see the "More Power to America" full-color sound slide-film "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

WHEN Freeport Sulphur expanded their production facilities they put in a new turbine to take care of the increased load.

At the same time they replaced all their old equipment with General Electric switchgear.

When you order G-E switchgear you get all the equipment and service from one reliable source. And with everything pre-assembled at the factory it takes very little time to get the switchgear in place and operating.

MODERN INDUSTRIAL power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want. . . .

- Proper voltage for top performance of equipment
- An extremely flexible setup to take care of expanding or changing loads
- Adequate short-circuit protection
- Protection for personnel
- Low installation and maintenance costs

INVESTIGATE TODAY the many advantages of using General Electric switchgear to get the same benefits gained by Freeport Sulphur. Contact your G-E sales representative for further information—or write for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3083 Metal-clad Switchgear
GEA-4966 Low-voltage Metal-enclosed Switchgear
GEA-3592 Load-center Unit Substations
GEA-3758 Load-center Power Distribution

GENERAL ELECTRIC

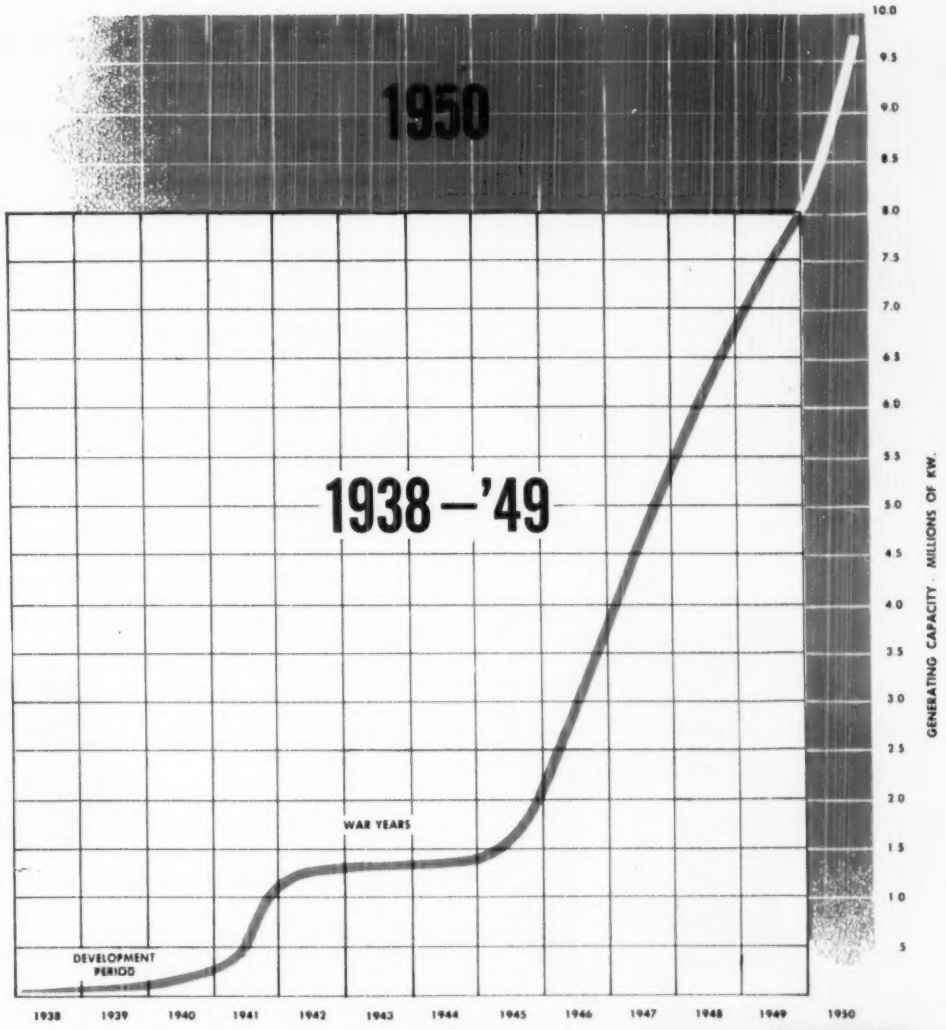
C-E Tilting Burners... more and for firing large boilers

The advertisement below, published in the fall of 1949, charted the remarkable postwar acceptance of the C-E Tilting Tangential Burner. On the opposite page the chart is reproduced and the curve extended to cover the period through September 1950. The record speaks for itself.

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS. ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

more the "Preferred Standard"



— SUPERHEATER, INC.

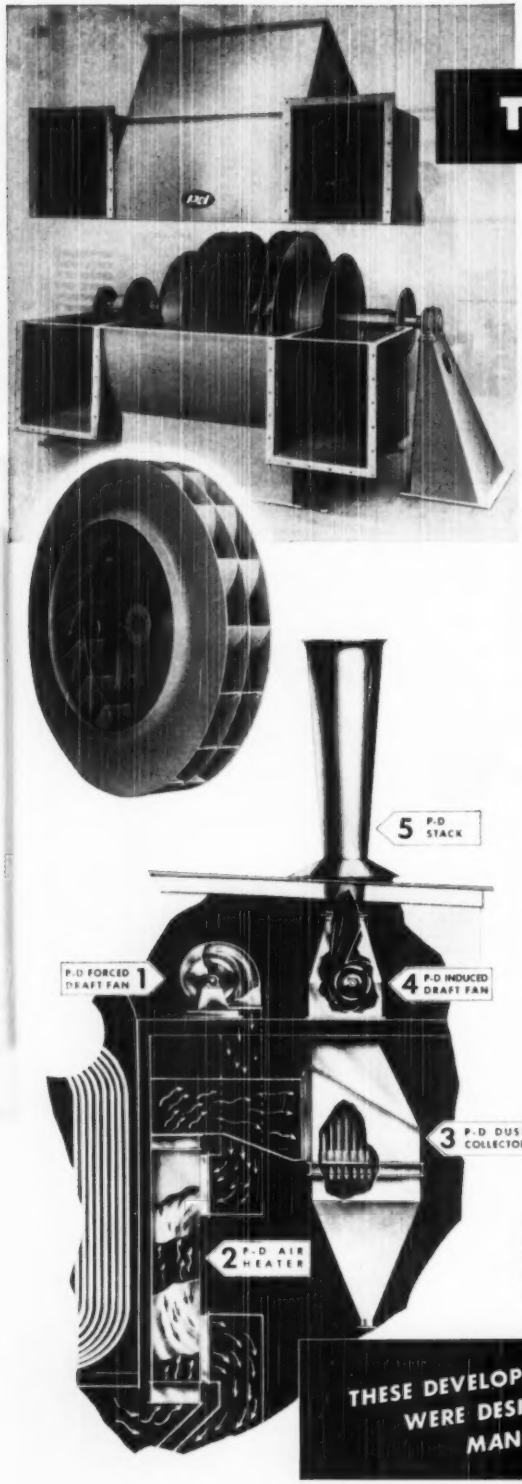
200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

TWO MORE P-D

AN F-D FAN THAT PROVIDES . . .

- *Transfer of more kinetic energy to static pressure*
- *More effective aerodynamic flow*
- *Lower horsepower requirements*
- *Appreciable reduction in fan noise*



An unusual combination of research facilities, and the best fan design talent of several countries,* are responsible for the development of P-D Forced Draft fan.

Peak efficiency and horsepower curves fall within normal fan selection ranges, providing optimum efficiency with non-overloading characteristics.

Improved diffusion from wheel to outlet permits a more complete conversion of kinetic energy to static pressure.

A backward curved, specially designed blade offers a more nearly perfect aerodynamic flow on both the leading and trailing surfaces, reducing eddy currents.

A larger, deeper inlet cone provides a smoother flow at the inlet, increasing over-all efficiency.

This new fan has been tested according to Standard Test Codes of the N.A.F.M. and the A.S.H.V.E. Write our project and sales engineers for the new bulletin No. *300* on this F. D. Fan.

*Prat-Daniel Experimental Laboratories, East Port Chester, Conn., The Balco Fan Works in Sweden, Prat-Daniel (Stanmore) Ltd., in Great Britain and Société Prat-Daniel of France.

UNDIVIDED RESPONSIBILITY

The illustration at left shows the 5 major boiler plant auxiliaries now built by Prat-Daniel; 1—F-D Fans, 2—Air Heaters, 3—Dust Collectors, 4—I-D Fans and 5—Fan Stacks. . . . In short, the equipment to handle the air-gas stream right through the plant, may now be purchased from a single experienced source, with the economies and advantages inherent to such unit responsibility.

THESE DEVELOPMENTS WERE DESIGNED AND MANUFACTURED BY: **PRAT-**

CONTRIBUTIONS TO EFFICIENCY

2 THE DECANTATION PROCESS . . .

A single stage, P-D Tubular Dust Collector, arranged to permit re-firing of high carbon dust without total re-circulation of flyash.

Comparative size

The well-known law, based on the inertia of a mass traveling at high velocities, suggested the design of an apparatus for separating large particles of high carbon content from flyash, for re-injection.

This is accomplished in a *single unit* by the P-D process of Decantation.* As the word implies, this collector literally pours off the larger particles into a hopper for re-firing, permitting the finer particles to enter the P-D tubes for precipitation and disposal, as shown in the illustration. Tests have proven that up to 40% of flyash from spreader stokers is generally suitable for re-injection. To obtain the best results from re-injection, and prevent the non-combustible particles from overloading, causing erosion and poor combustion, it is desirable that these particles be removed from the system.

Cut at lower right shows the space this P-D Decantation Collector requires in comparison with a standard unit. The Decantation unit actually occupies *less* area, (slightly more height), requires no more draft than is necessary to operate a standard tubular collector.

Our Project Engineers will be glad to send you this latest Bulletin No. 260D describing this apparatus.

*Pat. applied for.

PROJECT AND SALES ENGINEERS

THE THERMIX CORPORATION

GREENWICH, CONN.

Canadian Affiliates **T. C. CHOWN, LTD.,** 1440 St. Catherine Street W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

DANIEL CORPORATION

EAST PORT CHESTER, CONN.

Milestones of engineering

The modern Foster Wheeler Steam Generator, heart of many of the most efficient central station and industrial power plants in America and elsewhere, reflects the engineering and production ingenuity of an organization long recognized as a pioneer and innovator in the field of steam generation.

The story of Foster Wheeler achievement is best revealed by the following milestones of engineering progress:

1898—Aero pulverizers firing various fuels applied successfully on a commercial scale.

1902—Superheated steam introduced commercially in the United States.

1904—Convection superheaters standardized with cast iron, extended surface rings applied to steel tubes. Bare tubes later used with improved design technique and improved metal selection.

1912—Air preheaters of tubular type built and operated. Plate type heaters followed a few years later.

1917—Water tube boilers designed for production on a large scale—both oil and coal fired.

1919—Economizers of high pressure, extended surface, unit type introduced.

1919—Radiant superheaters developed after long research and experimentation.

EXPERIENCE...the priceless

progress

1924—Water walls and water backs applied to many types of furnaces burning various fuels.

1934—Pulverized anthracite burned in direct-fired system eliminating need for pulverized fuel storage.

1935—Radiant reheaters and radiant superheaters installed in one of the first large high pressure reheat units in the country.

1936—Twin furnace steam generators of the separately-fired superheater type (shown upper right) developed to give steam temperature control over load ranges up to 10 to 1.

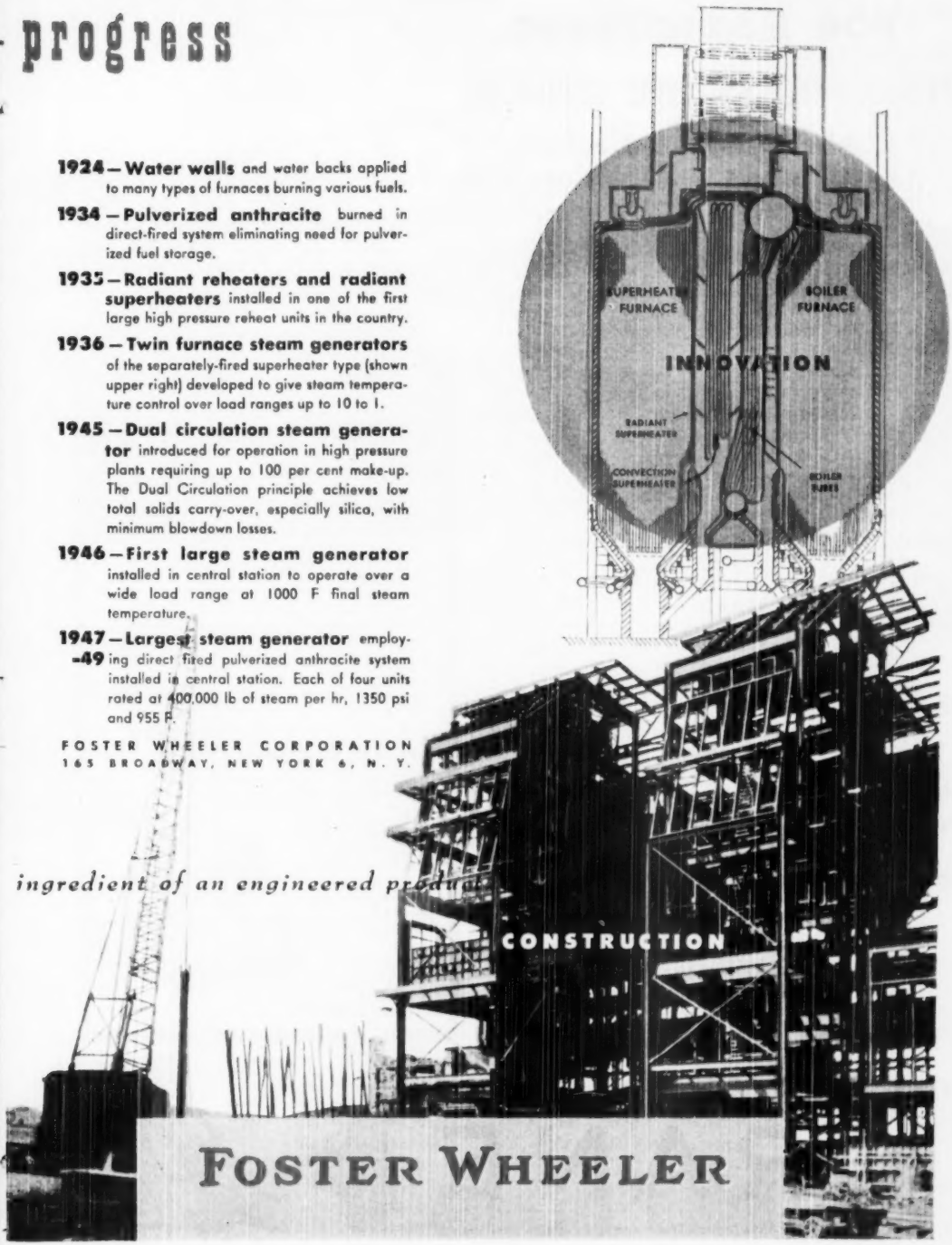
1945—Dual circulation steam generator introduced for operation in high pressure plants requiring up to 100 per cent make-up. The Dual Circulation principle achieves low total solids carry-over, especially silica, with minimum blowdown losses.

1946—First large steam generator installed in central station to operate over a wide load range at 1000 F final steam temperature.

1947—Largest steam generator employing direct fired pulverized anthracite system installed in central station. Each of four units rated at 400,000 lb of steam per hr, 1350 psi and 955 F.

1949

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.



ingredient of an engineered product

FOSTER WHEELER

NONE BETTER FOR HARNESSING HIGH PRESSURE STEAM

CRANE PRESSURE-SEAL BONNET GATES, GLOBES, ANGLES, STOP-CHECKS

(Patented and Patents Pending)

Unlike conventional flanged bolted bonnet design, these Crane valves don't have to fight pressure to hold it. Instead, they actually utilize the forces of pressure to seal the bonnet joint. The higher the pressure, the tighter the seal. Not only does the Crane Pressure-Seal Bonnet principle eliminate bonnet joint sealing problems, it makes possible many outstanding improvements such as the following:

NO BONNET JOINT LEAKAGE—NO BONNET JOINT MAINTENANCE—Because Crane design utilizes line pressure to the maximum degree to make the seal, final pressure tightness at the bonnet joint does not depend on any bolting. This eliminates the need for periodic restressing of the joint.

SAVINGS IN WEIGHT AND SPACE—Up to 60% lighter, in the case of larger size 1500-Pound Gates. Easier to handle. Require less head room. Save on erection and suspension costs.

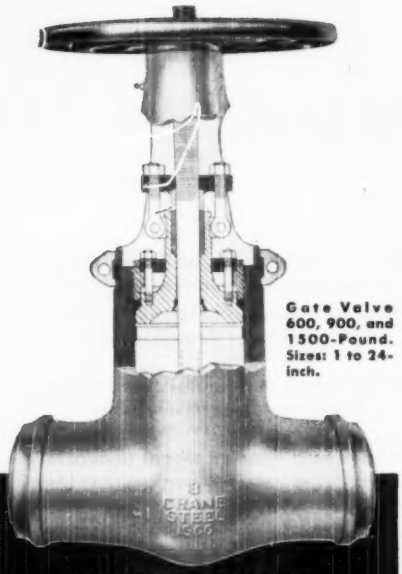
LOW PRESSURE DROP DESIGN—Performance tests prove conclusively that Crane Pressure-Seal Bonnet Valves have superior flow characteristics under all conditions of service.

STREAMLINED BODY—Smooth flowing contours with no abrupt changes in metal thickness minimize stresses caused by pressure, temperature differences, and pipe line strains.

EASY TO INSULATE—Streamlined design simplifies application of insulation and requires less material. Valves can be opened or reassembled without disturbing insulation.

SEND FOR NEW CIRCULAR AD-1819—Illustrates and describes the Crane Pressure-Seal Bonnet principle, and gives all essential data for specifying these valves. Get a copy from your Crane Representative, or **WRITE FOR CIRCULAR AD-1819.**

CRANE Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas.



Gate Valve 600, 900, and 1500-Pound. Sizes: 1 to 24-inch.

HOW LINE PRESSURE KEEPS THIS BONNET JOINT PRESSURE-TIGHT

Bonnet joint is inside the valve, sealed with a wedge-shaped seal ring. Internal fluid pressure, acting upon the entire underside of the bonnet, forces the bonnet against the seal ring; this wedges the seal ring between the body and bonnet, forming a pressure-tight metal-to-metal joint.

LIGHTER AND SMALLER

Crane 8-inch 1500-Pound Pressure-Seal Bonnet Gate compared with conventional 8-inch 1500-Pound bolted bonnet gate valve.

Angle Stop-Check 900 and 1500-Pound. Sizes: 6 to 12-inch.

Y-Pattern Globe 900 and 1500-Pound. Sizes: 1 to 4-inch.

EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

Here is the New Yardstick for Crawler Tractor Performance

Allis-Chalmers HD-20 Hydraulic Torque Converter Tractor

● **BIG AND RUGGED** . . . 41,800 lb. of properly balanced weight . . . long, wide, sure-gripping tracks. Handles the toughest jobs in stride!

● **POWERFUL** . . . Newest, latest GM 2-Cycle Diesel Engine; Model 6-110. Plenty of POWER . . . for longer life, lower maintenance, increased production.

● **HYDRAULIC TORQUE CONVERTER DRIVE** that eliminates most gear shifting and keeps tractor working smoothly at higher average speeds.

● **SIMPLE UNIT ASSEMBLY** . . major assemblies removed and repaired or replaced without removing adjacent parts.

● **EXTENDED LUBRICATION PERIODS THROUGHOUT** . . . plus 1,000-hour periods on truck wheels, track idlers and support rollers with A-C's POSITIVE SEAL.

● **EVERY OPERATOR COMFORT** . . . seat, platform, controls, visibility . . . hydraulic finger-tip steering, self-energizing brakes, practically no gear shifting.

Get the full story from your Allis-Chalmers dealer. Arrange for a demonstration on your job at the earliest opportunity.

World's Finest Tractor

For Greater Production
For Easier Operation
For Simplified Servicing

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Originator of the Torque Converter Tractor

The Canton Binfeed - Another
TO SOLVE YOUR STOKER

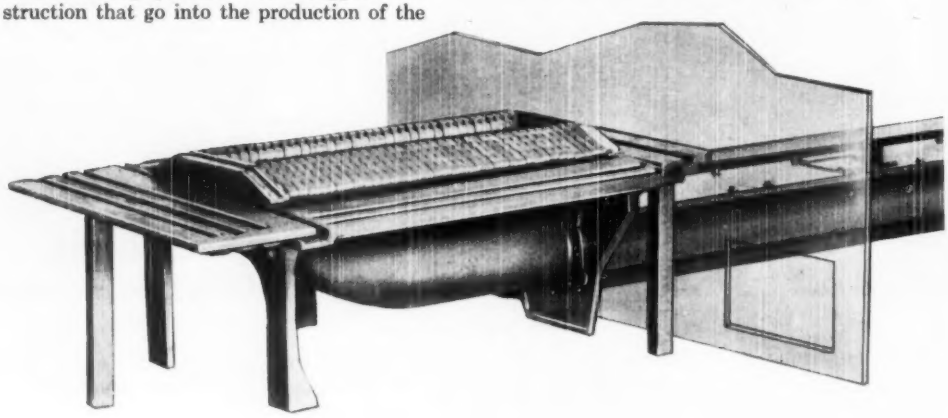
When buying stokers, make sure the equipment you buy fits your operating requirements *exactly*. The dependability of Canton Stokers, established in thousands of installations during the past 40 years, will guarantee you the finest performance in *your* operation because they are designed specifically for YOUR firing and combustion demands.

Keeping pace with the Canton policy of meeting *all* stoker requirements, the CANTON BINFEED STOKER offers several specific operating advantages — less coal handling . . . higher combustion efficiency . . . lower maintenance costs . . . and, most important, CANTON OPERATING RELIABILITY.

The top-quality materials, engineering and manufacturing precision, and rugged construction that go into the production of the Canton Binfeed Stoker would produce an excellent stoker under any standards. But Canton has added exclusive features that provide a superior product which delivers a superior performance.

A binfeed stoker may be your answer to higher firing efficiency. Call or write your nearest Canton Stoker representative. He will be glad to show you, without obligation, how Canton Binfeed Stokers will fit your requirements exactly.

CANTON STOKER CORPORATION
Andrew Place, S. W., Canton, Ohio
CANADIAN REPRESENTATIVE: Volcano Ltd.,
743 Mountain Street, Montreal 3, Quebec
EXPORT DIVISION: W. B. Harkins,
751 Drexel Building, Philadelphia 6, Pa.



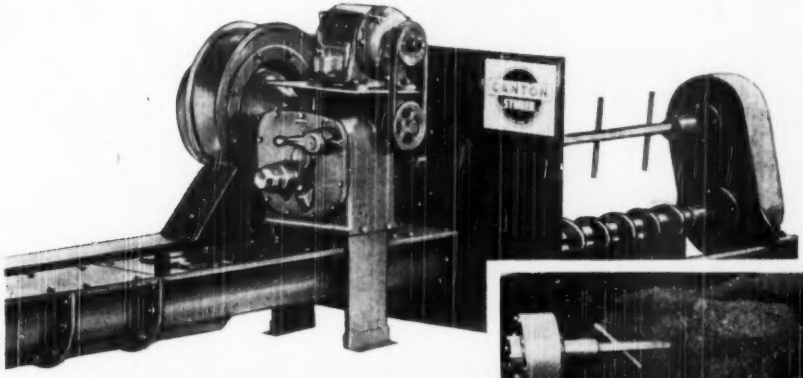
CANTON
SINCE 1910

Advancement PROBLEMS *EXACTLY!*

CANTON STOKERS

CHECK THESE POINTS

- ✔ **DUAL-DRIVE COAL AGITATOR** — Prevents packing or bridging of coal.
- ✔ **SECTION FEED WORM** — Provides easy removal for maintenance or cleaning.
- ✔ **SIDE ASH-DUMPING GRATES** — Reduces labor in cleaning fires and removing ashes.
- ✔ **ZONED AIR CONTROL** — Produces high-efficiency combustion and maximum fuel economy.
- ✔ **AUTOMATIC CONTROLS** — Provide full-automatic operation.
- ✔ **UNIT OR SEPARATE BLOWER DRIVE** — Gives added flexibility to the installation.
- ✔ **DRIVE UNIT ACCESSIBILITY** — Permits, easy, quick access to all drive parts.
- ✔ **RUGGED CONSTRUCTION** — Assures long uninterrupted service under severe operation.



CANTON DURAFLEX BINFEED STOKER

The rugged unit shown here is designed with the drive mechanism and blower units mounted at the outer wall of the coal storage bin.

Action view of the Canton coal agitator and pickup worm, showing completely closed construction of drive gear mechanism.

CANTON RAM FEED STOKER DRIVE MECHANISMS ARE GUARANTEED FOR FIVE YEARS

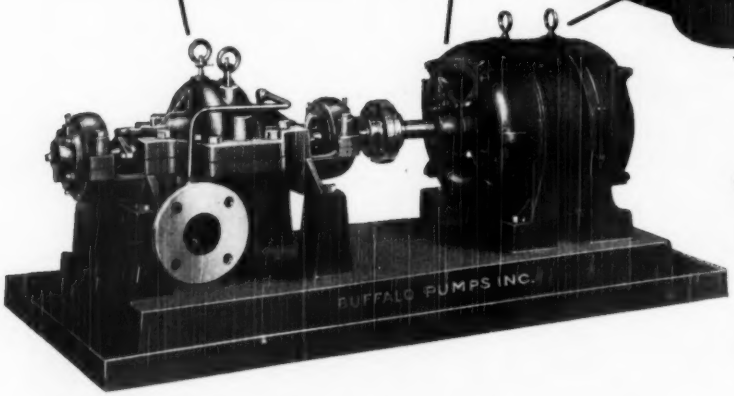
STOKER

CANTON STOKER CORP. CANTON 1, OHIO

For Pressures up to 1500 Ft.

For Clear Water Service

Efficient at any Temperature



"Buffalo"
"RR"
PUMPS

READY TO CUT YOUR PUMPING COSTS

If you have a clear-water pumping application calling for a high head and capacity between 20 to 900 gpm., you'll get satisfaction with an "RR". These "Buffalo" Single Suction Two and Four Stage Pumps have set both efficiency and endurance records on the job — in air conditioning, boiler feed and other general service. Thousands in use all over the country. WRITE FOR BULLETIN 980-B for the facts on these pumps users say you can "put in and forget".

—for handling clear water at high pressures, any temperature
"Buffalo"
Class "RR" Single Suction Multistage Pumps
BUFFALO PUMPS, INC

BUFFALO PUMPS, INC.

488 BROADWAY BUFFALO, N. Y.

Canada Pumps Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

25-YEAR-OLD "Buffalo" DRAFT FANS PROVE THE ECONOMY of DURABILITY

25 YEARS AFTER INSTALLATION: THESE BUFFALO PRIMARY FANS STILL ON THE JOB

25 YEARS AFTER INSTALLATION: THESE BUFFALO FORCED DRAFT FANS STILL ON THE JOB

25 YEARS AFTER INSTALLATION: THESE BUFFALO INDUCED DRAFT FANS STILL ON THE JOB

Wherever steam is produced for energy, you find a key industry. In every key industry you find "Buffalo" Mechanical Draft Fans represented—and doing a reliable job of keeping boiler combustion efficient.

In the Public Utility companies, where above all, power production must be *continuous*, "Buffalo" Draft Fans are proving that they can be relied on for remarkably long service periods.

The 24 "Buffalo" Draft Fans at Miami Fort Station, Cincinnati Gas & Electric Company, illustrate this durability. They are still in service after 25 years on industry's toughest fan job.

If you want the draft economy that comes only from rugged fan construction in the right places, specify "Buffalo." WRITE FOR BULLETIN 3750 for all engineering details.

"Buffalo" FIRST FOR FANS

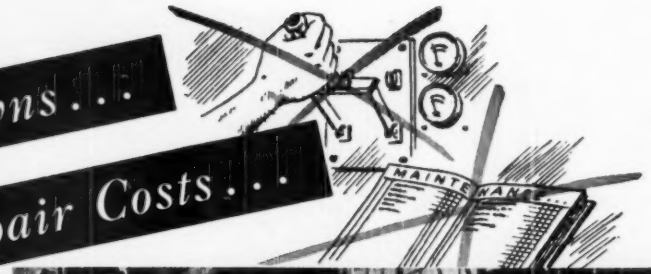
BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

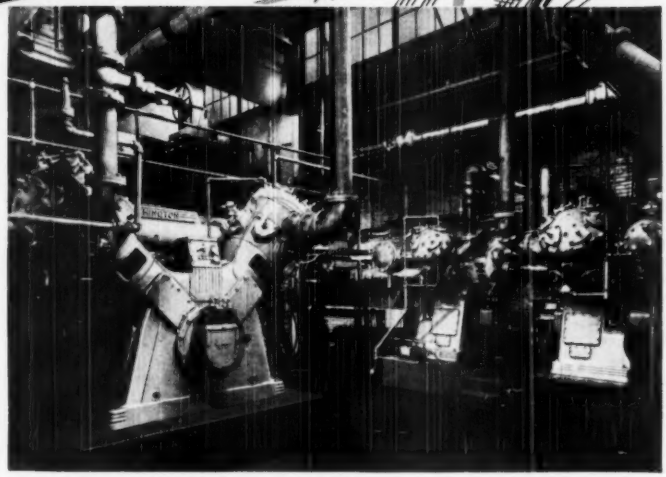
Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

No Shutdowns . . .
No Repair Costs . . .



IN 30 MONTHS OF STEADY OPERATION!



Three Worthington YC-2 Compressors on general air service in the Reo Motors Company Plant, Lansing, Michigan. Two of these units ran for 2½ years, the other (a later installation) for 2 years, before all three had their first routine examination. During that time they operated approximately 16 hours per day, 5 days per week, without a single shutdown for maintenance.

Worthington YC-2 Compressors Provide Reo Motors Plant With Trouble-Free, Low-Cost Air Service

Freedom from maintenance worries is just one of the many advantages you get with Worthington YC-2 Compressors. Installation is quick, easy and inexpensive. A YC-2 comes completely assembled — there's no alignment problem and you don't need an erecting engineer. Requiring only half the space and one-quarter the foundation of same-capacity horizontals, it's ready for work as soon as connections are completed — at big savings in time, labor and money.

You get steady savings on operating costs, too, thanks to advanced features like the balanced Y-frame for higher rpm . . . the power-thrifty, instantly responsive 3 and 5-step variable capacity control . . . and Worthington Feather* Valves, most efficient and economical ever made.

GET ALL THE FACTS

on how YC-2's can cut your air costs — from the first day on! Bulletin L-667-B1A gives you the whole economy story with further proof that *there's more worth in Worthington*. Write to *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

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NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

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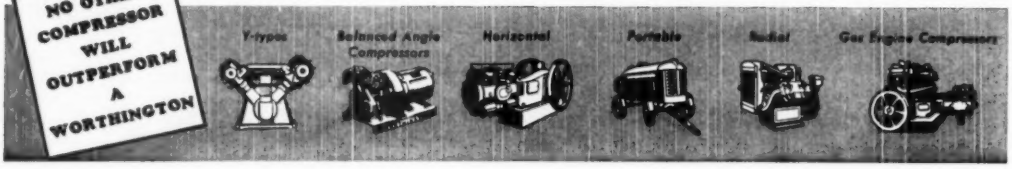

If you need a control mechanism which can **combine** control signals

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In all except the very simplest control systems, there is need for control mechanisms which can combine control signals. Some of these combinations involve addition or subtraction of control signals, while others involve multiplication, division, or even more complicated functions. The Hagan Ratio Totalizer was designed for almost universal application in this type of service. It represents an advance in simplicity and versatility over all devices of this class which have been available previously.

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P-12

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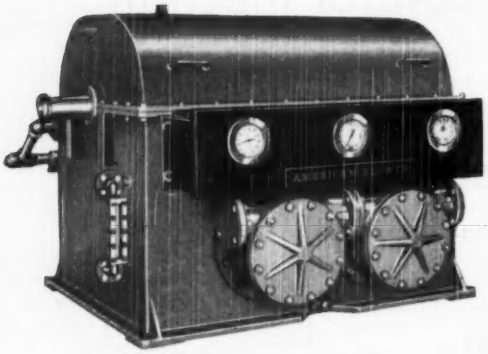
GÝROL FLUID DRIVES FOR BOILER FEED PUMPS



Type VS, Class 6 Gýrol Fluid Drive for Boiler Feed Pumps

American Blower Type VS, Class 6 Gýrol Fluid Drive is designed specially for the heavy duty required of high-speed (3600 RPM) boiler feed pump drives.

It offers these important advantages to power plant operators:

1 **Power Savings**—the adjustable speed feature of Gýrol Fluid Drive offers a substantial saving in power.

2 **Flexibility of Control**—the narrow range of speed over which a boiler feed pump must operate (15 to 25% of motor speed) requires a quick, easy control, capable of fine increments of speed adjustment. The infinitely adjustable speed control of Gýrol Fluid Drive, together with its rapid response, meets this specification.

3 **Lower Pressures**—in many high-pressure boiler installations, reduction in pressure from adjustable speed operation amounts to 500 lbs. and more, at reduced flows. This pressure reduction considerably lowers the duty on piping, high-pressure heaters and valves.

4 **Reduced Maintenance**—it follows that adjustable speed reduces wear on pumps and the large pressure reduction from adjustable speed operation prolongs the life of equipment and reduces maintenance.

American Blower Gýrol Fluid Drives for boiler feed pumps are already being used by many of America's newest and finest public utilities.

For the complete, concise, factual data on Gýrol Fluid Drives for boiler feed pumps, write for our Bulletin 8019. And if you'd like data on American Blower Mechanical Draft Fans, Fly Ash Precipitators, Heavy Duty Coils and Gýrol Fluid Drive for fan control—write, stating your requirements, or phone our nearest branch office.

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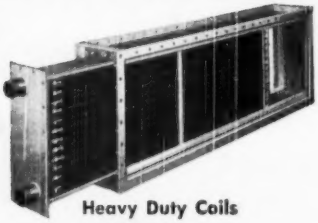
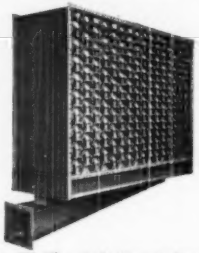
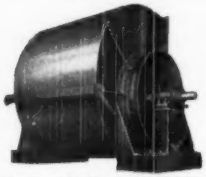


Heavy Duty Coils

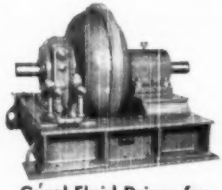


Type ST Fly Ash Precipitators



American HS Forced Draft Fans

Sirocco Induced Draft Fans



Gýrol Fluid Drives for Mechanical Draft Fans

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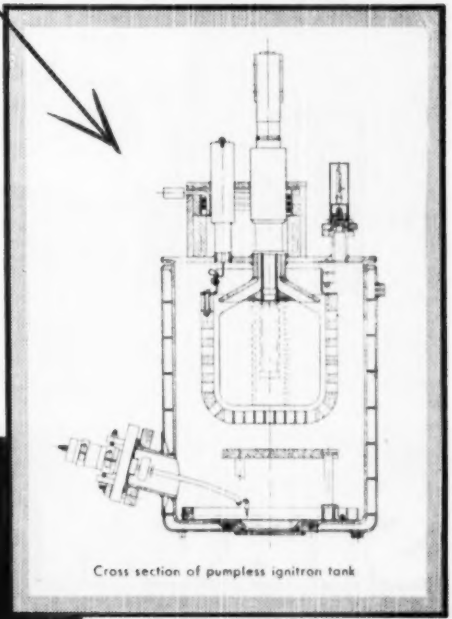

Cross section of pumpless ignitron tank

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Inverted bucket in-line trap. To 250 p.s.i. Sizes ½" to 1".
Inverted bucket trap. All stainless fitted. To 250 p.s.i. Sizes ½" to 2½".
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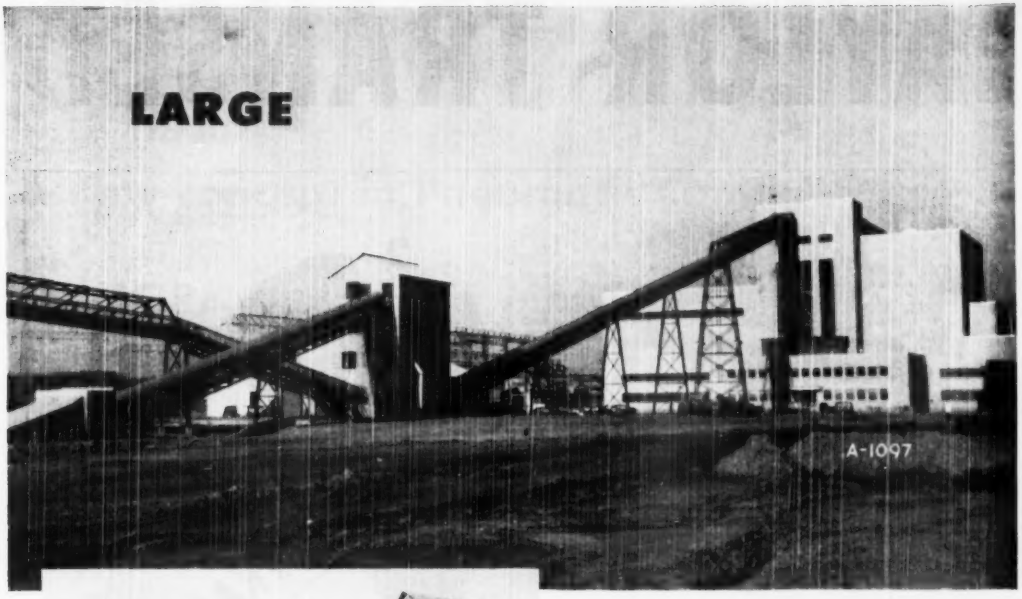

At moderate-sized power plant shown directly above, S-A REDLER Conveyor-elevator moves coal from under railroad trestle and storage pile up to cylinder storage bin on boiler house roof for gravity discharge into boiler house. Handling capacity . . . 15 tons per hour.

Large generating plant (top photo) is served by S-A Belt Conveyor System handling up to 300 tons per hour—direct from track hoppers to bunkers or to outdoor storage for later reclaiming. The several inclined belt conveyors total 880 feet.

See Our Exhibit and the DOUBLE ROTOR KNITTEL CRUSHER at Booth Nos. 218-220 NATIONAL POWER EXPOSITION Nov. 27—Dec. 2

S-A Equipment Handles Coal and Ash at Lowest Cost for Power Plants of

Any Size

● The wealth of experience on which the S-A engineering staff draws came from installations of *all sizes*. Anywhere coal and ash are handled, S-A will have recommendations to make—always in the direction of higher efficiency and lower costs.

Your plant is not too large to benefit from this high degree of specialized engineering skill—and we have, no doubt, brought economies to many plants smaller than yours. Acquaint us with your operation and let us see what we can do for you. Write today . . . there is no obligation.

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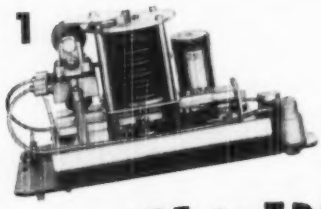
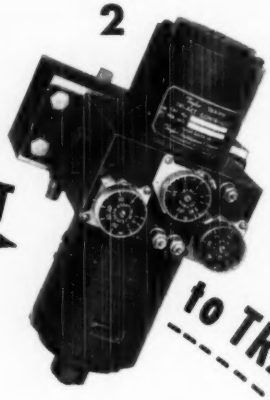


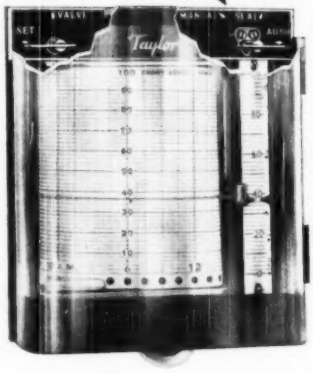
TRANSAIRE to TRI-ACT



to TRANSET

Tinker to Evers to Chance had nothing on Taylor's TRANSAIRE* to TRI-ACT* to TRANSET*. It, too, is a well-coordinated combination. It combines three stars to make the fastest, most dependable pneumatic transmission system on the market.

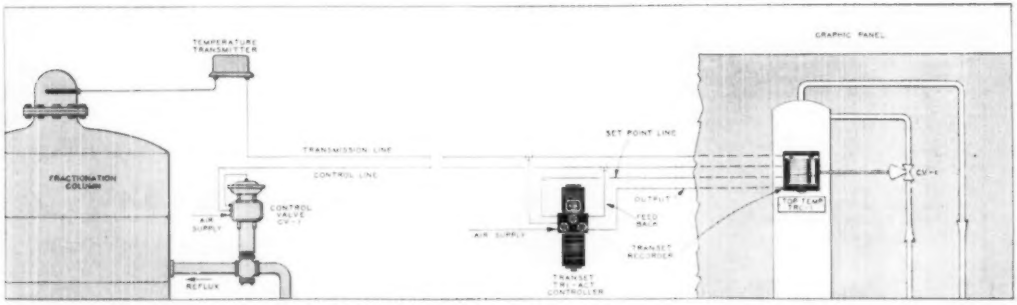
3



1. TRANSAIRE. A force-balance temperature or pressure transmitter. SPEED-ACT* gives rate action in the measuring circuit to compensate for process lags. Narrow range spans. Standard 3 to 15 psi output. Interchangeable unit construction.

2. TRI-ACT Controller. A force-balance controller with a new circuit . . . a new concept in process control. High capacity relay air valve for faster response of control circuit. Wider response adjustments than ever before. Panel or locally mounted.

3. TRANSET Recorder. Fits $3\frac{7}{8}$" x $4\frac{1}{2}$" opening . . . a natural for graphic panels, a great space saver for conventional panels. Powerful actuation—bellows operated rectalinear movement. 30-day chart, 3-hour visible record. Everything needed for remote control.



CONTROL SYSTEM

A new concept in Pneumatic Control:

- ***MORE ACCURATE MEASUREMENT***
- ***CLOSER CONTROL ON ANY PROCESS***
- ***CONTINUOUS SPACE-SAVING RECORDS***
- ***HIGHER PROCESSING EFFICIENCY***

FASTER, more accurate and sensitive measuring devices can't be of maximum value unless the control mechanism can act upon the measured impulses as fast as they occur. Taylor has developed a new controller and a new recorder to take advantage of faster measuring devices, such as TRANSAIRE Temperature and Pressure Transmitters and the Aneroid Manometers for Flow and Liquid Level. These individual developments, each designed to take advantage of the other's superior performance, are now available in a complete system. The result is unprecedented quality of process control.

1. FASTER MEASURING INSTRUMENTS. Taylor's TRANSAIRE, force-balance temperature or pressure transmitters, created new standards in the measurement of *changing or dynamic* temperatures and pressures. TRANSAIRE, with derivative action (SPEED-ACT), transmits temperature changes with unbelievably fast accuracy. Other advantages: Temperature and barometric compensation; Interchangeable unit construction; Standard 3 to 15 psi output air pressure. On pressure applications, range spans of 20 and 40 psi available throughout range limits of 35 to 415 psia.

2. FASTER CONTROL with *Stability!* Taylor's new TRI-ACT Controller combines a wider range of response adjustments, an increased capacity relay air valve, and a *new control circuit*, to take advantage of the faster measuring systems. This new force-balance controller permits 4 times faster reset rate and 4 times faster rate action (PRE-ACT*) than conventional controllers. It eliminates overpeaking, and gives faster recovery for load changes on pressure, flow, and temperature applications—because rate action is in *the new circuit*. The new controller is adaptable to *your* process requirements. Can be locally mounted if needed for better quality of control, or panel mounted. You make the decision!

3. MIDGET RECORDER saves space. Taylor's new TRANSET Recording Receiver greatly reduces panel space. Fits $3\frac{7}{8}$" x $4\frac{1}{2}$" panel opening, making it especially adaptable to graphic panels. It gives continuous 30-day process record, with 3 hours visible—remote setting of control point—automatic to manual control—instant check on controller performance and the control valve position. ALL THESE—right where you want them. TRANSET Indicator fits into same size cut-out. Many parts interchangeable.

We sincerely believe this new Taylor-engineered TRANSET Control System combines the *best transmitter, the best controller, and the best recorder* on the market. It sets new standards in speed, accuracy, and dependability of pneumatic transmission systems. Find out more about it, and put it to work for you! Write for **Bulletin 98097,** and ask your Taylor Field Engineer. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

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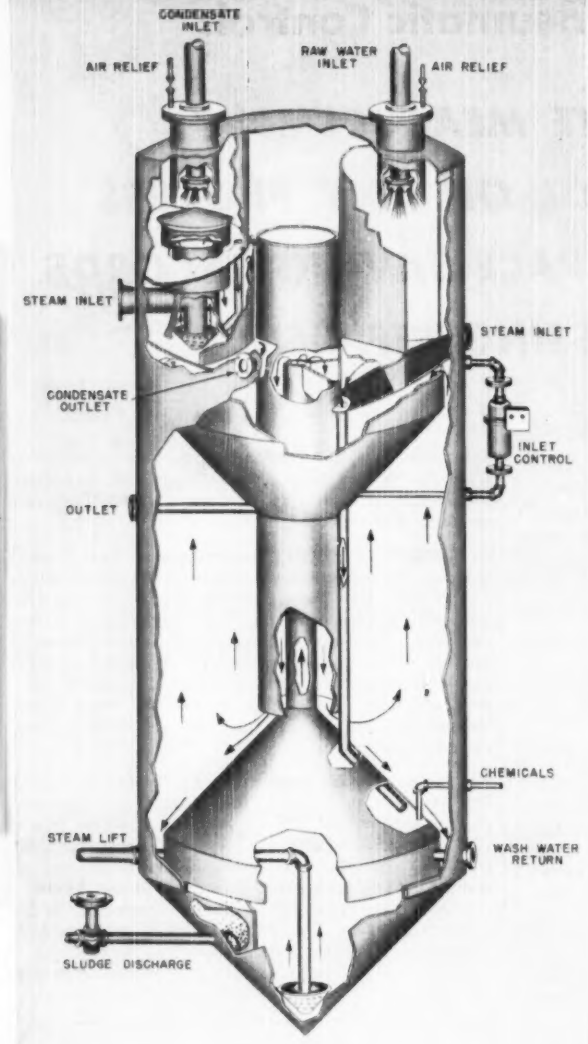
The Hot Process ACCELATOR®



MULTI-PASS TREATMENT FOR

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- ***Silica Reduction***
- ***Deaeration of Makeup and Condensate***

HERE'S THE ANSWER TO 3 OF THE POWER ENGINEER'S MOST COMMON PROBLEMS

SOFTENING: Positive internal slurry recirculation insures maximum softening, alkalinity reduction, and turbidity removal with a minimum of chemical expenditure. A steam lift effects the recirculation thereby eliminating mechanical pumping devices. A storage compartment within the tank holds sufficient treated water to handle momentary peak demands.

SILICA REDUCTION: Prolonged contact of the water undergoing treatment with the recirculating slurry as well as the redissolving of magnesium in the slurry, reduce silica to a new low.

DEAERATION: The steam lift effectively deaerates the makeup water undergoing treatment, thereby eliminating the need for separate deaerating mechanisms. The condensate enters a separate chamber in the upper portion of the tank and is recycled and scrubbed by its own steam lift system.

Check these advantages of the Deaerating Hot Process Accelator: 1. Self-contained deaeration for both makeup and condensate, 2. Controlled slurry recirculation, 3. Maximum silica reduction by the redissolving of magnesium, 4. Reprecipitation for chemical economy, and 5. An effluent low in turbidity, alkalinity, and hardness. Investigate the new Deaerating Hot Process ACCELATOR. Write for complete information, now.

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Cover photo: Night view of Redondo Steam Station, Southern California Edison Co.

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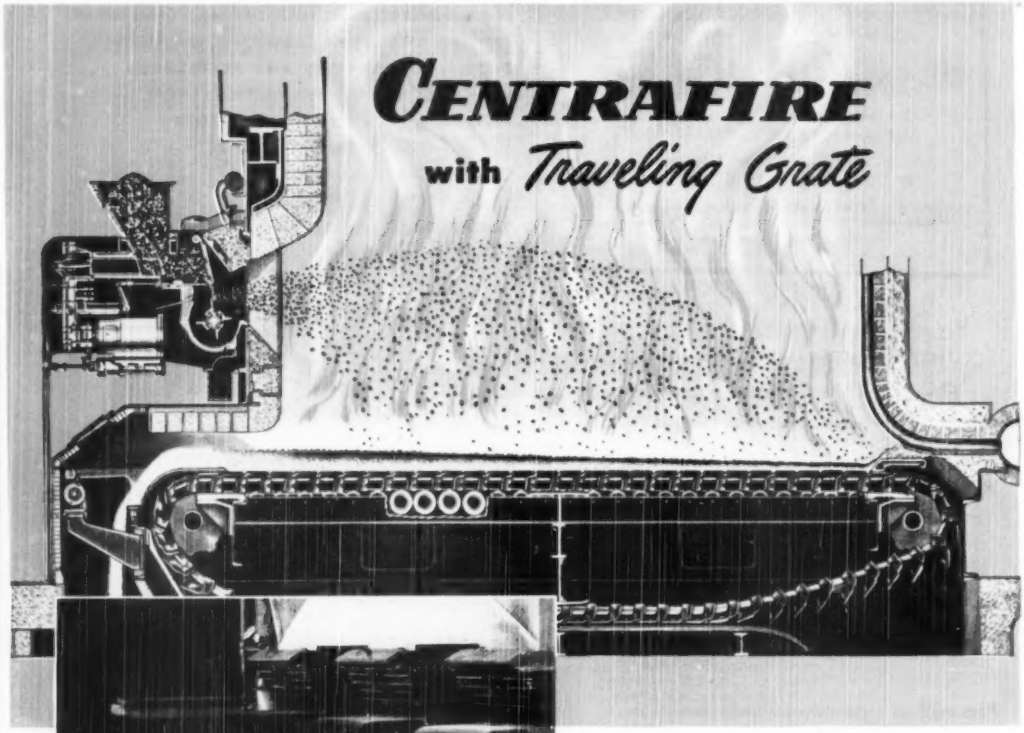
YOU CAN BE **SURE**.. IF IT'S

Westinghouse



A group examines some of the foreign material used in a punishing test of the feeding mechanism of a Centrafire with Traveling Grate. The original demonstration was conducted at the Westinghouse Plant at Trafford, Pennsylvania, on May 8 and 9, 1950. If you would like to see this test repeated, ask your nearby Westinghouse Steam Specialist for a showing.

YOURS FOR THE ASKING

Send for the complete report on the Centrafire with Traveling Grate test. Books are also available on either the Traveling Grate or Link-Grate Centrafire Stokers. Write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

COULD YOUR STOKER PASS THIS TEST?

The ability of the Centrafire with Traveling Grate to "take it" and continue to operate without loss of load under extreme conditions has been repeatedly demonstrated in tests like this one. Wet fuel and extraneous matter were handled without interfering with operation. Tests such as this prove that Centrafire feeders are virtually non-stallable. The unusual or large obstruction that causes difficulty is quickly and easily removed. Read these excerpts from the actual test report:

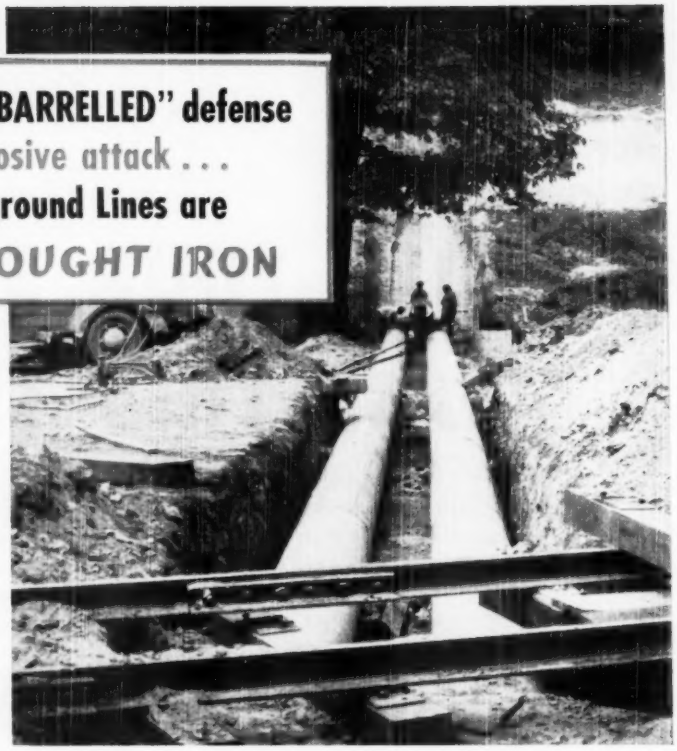
- **A half brick**—passed through center feeder without incident on both rotor and steam-jet operation.
- **Blocks of wood**—of two sizes, both sheared pins in feeder, but were removed without loss of load or pressure.
- **Ceramic Insulator**—passed through feeder without incident.
- **A piece of BX cable**—3½ feet long—wound around rotor, but did not stop or interfere with operation of the rotor.
- **Two bolts**—⅝" x 5½"—fed through feeders and into furnace without incident.
- **Steel cable**—forty-six inches of ½", fed through feeder endwise, worked through and into furnace without incident.
- **Market coal**—½" x 0", bone dry, was wet down at the coal conveyor and successfully fed into furnace without incident.
- **Extremely wet coal**—with continuous stream of water running out of all feeders—was fed with no adverse effect. Some wet coal accumulated on the feeder sills in the furnace but was easily removed with poker.

The outstanding performance of the Centrafire with Traveling Grate stems from features that are built in—not added as accessories. All moving elements are hydraulically operated by one turbine- or motor-driven oil pump. This assures infinite flexibility through the complete range of operation—synchronizes coal feed and grate speed. The Centrafire's range extends upwards of 300,000 lbs. of steam per hour. It will pay you well to get the full Centrafire Story.

J-50515

Westinghouse
STOKERS

Here's "DOUBLE-BARRELLED" defense against corrosive attack . . . Twin Underground Lines are BYERS WROUGHT IRON



There's a *double* corrosive threat to underground water lines . . . inside attack from water; outside attack from soil . . . so Elliott Company, Jeannette, Pa., set up a "double-barrelled" defense against these hazards by selecting wrought iron for their twin underground piping. Running from the cooling tower to the condensers, these 1200 ft. lines were fabricated from ¼" Byers Wrought Iron plate into 20" pipe by the Reliance Steel Products Company.

Companies in all sections of the country are using this same time-tested method to forestall early and costly repairs and replacements. They realize that successful, economical operation depends heavily on the proper selection of materials. Byers Wrought Iron has demonstrated its exceptional qualities in practically every corrosive service, and provides a sound means of getting maximum life from every underground installation, with minimum maintenance.

There is plenty of engineering precedent to support the choice of wrought iron for this demanding service. For one example: . . . a 200 ft. water main, removed after 54 years of service, was reported free of holes and thin spots. It was cleaned and placed in stock for making repairs and replacements. The pipe used to replace the 54 year old material was wrought iron that had seen 35 years of duty before it was removed and cleaned.

For another . . . in a mid-west community, wrought iron lines were reported as still serving after 43 years. Ordinary material had lasted only 14 years in this area.

Examples could be multiplied almost indefinitely . . . but these will suggest the splendid performance of wrought iron.

If you have any underground lines in prospect, you'll find some helpful information in our bulletin WROUGHT IRON FOR UNDERGROUND SERVICES. We will be glad to send you a copy on request.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N.Y.

WHY WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

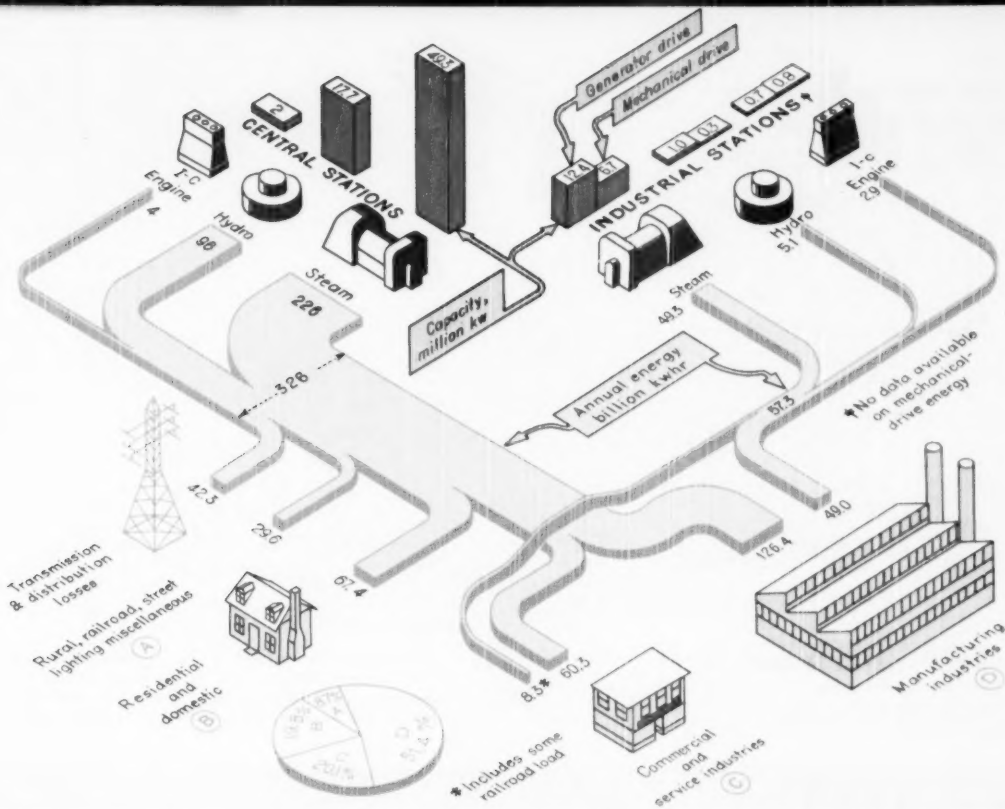
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



U. S. POWER PLANT at end of 1950 shapes up like this: 69 million kw of capacity in central stations *(upper left)*, 21.9 million kw in industry's own plants *(upper right)*. Electrical energy from both *(orange)* powers industry and commerce. Based on Power estimate

POWER TO REARM

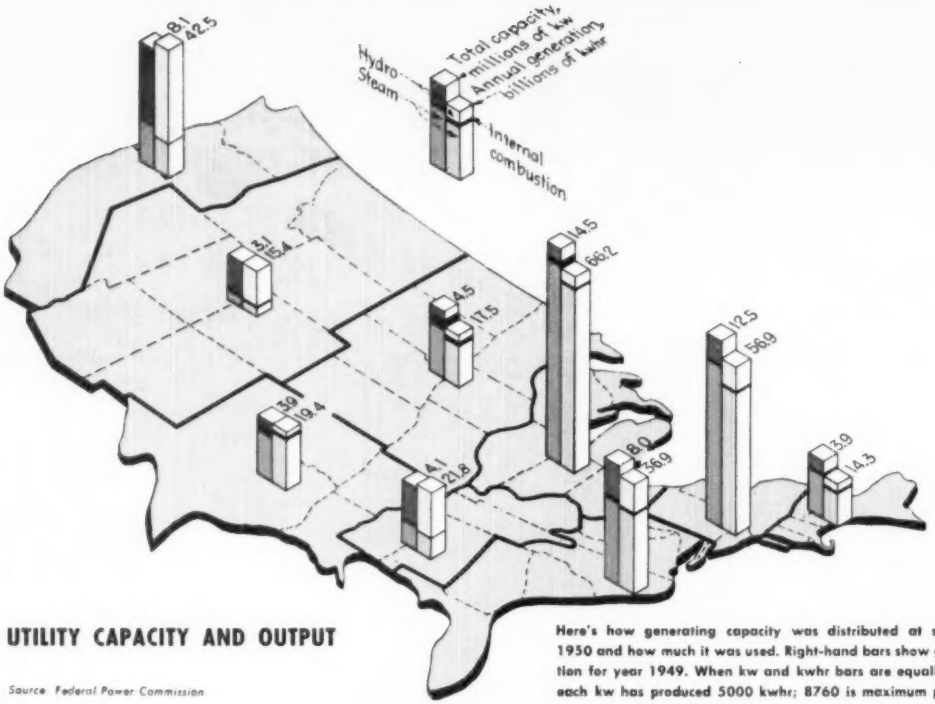
Take a good look at the picture above. It's just about as important as any you'll see. Important to industries gearing for a new production drive, to top-brass planners restoring U. S. defensive strength, to GIs in Korea and on frontiers that might be future Koreas. And, not least, to power engineers.

It's our U. S. power plant at year's end, 1950. It's bigger than any nation's past or present, vastly greater than it was when World War II ended. Yet we'll need every kw of it, plus millions of kw now building and planned, perhaps even more. For power is the heart's blood of industry, producer of the tools for defense and for the peace a strong defense can win for us and for the world.

Under the stress of times ahead, the picture will change. The plant will grow larger. Its energy stream will increase to an even greater extent, will channel more and more into manufacturing industry. To foresee the shape of these and other changes, to be ready for them, is our job as power men — the engineers who built this greatest of all power plants and who must keep it running.

Now, as the big push begins, is the time to see where we stand, what problems lie ahead. The following pages will help in such thinking. They show graphically how this national power plant of ours is distributed geographically, how it has grown and performed in the war and postwar years just past. And by summarizing quickly the experiences and lessons of World War II they cast a ray of light ahead.

Tight as things got at times, power men can take sober pride in the fact that the past war's progress was never slowed by lack of our products. Again we face that challenge. Let's make no mistake about it. We've got a big job on our hands — to give America ample and unfailing power to rearm.



UTILITY CAPACITY AND OUTPUT

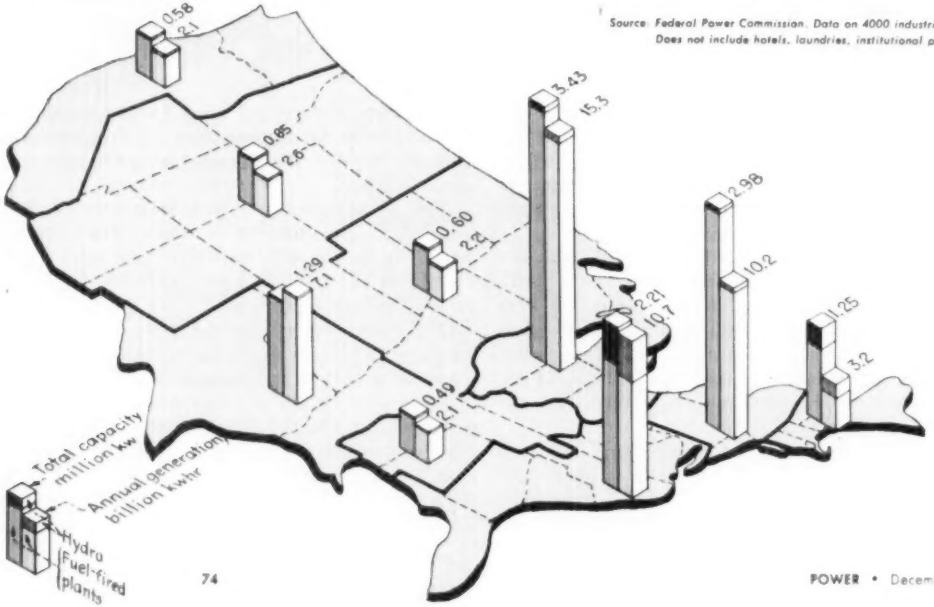
Source: Federal Power Commission

Here's how generating capacity was distributed at start of 1950 and how much it was used. Right-hand bars show generation for year 1949. When kw and kwhr bars are equally high, each kw has produced 5000 kwhr; 8760 is maximum possible

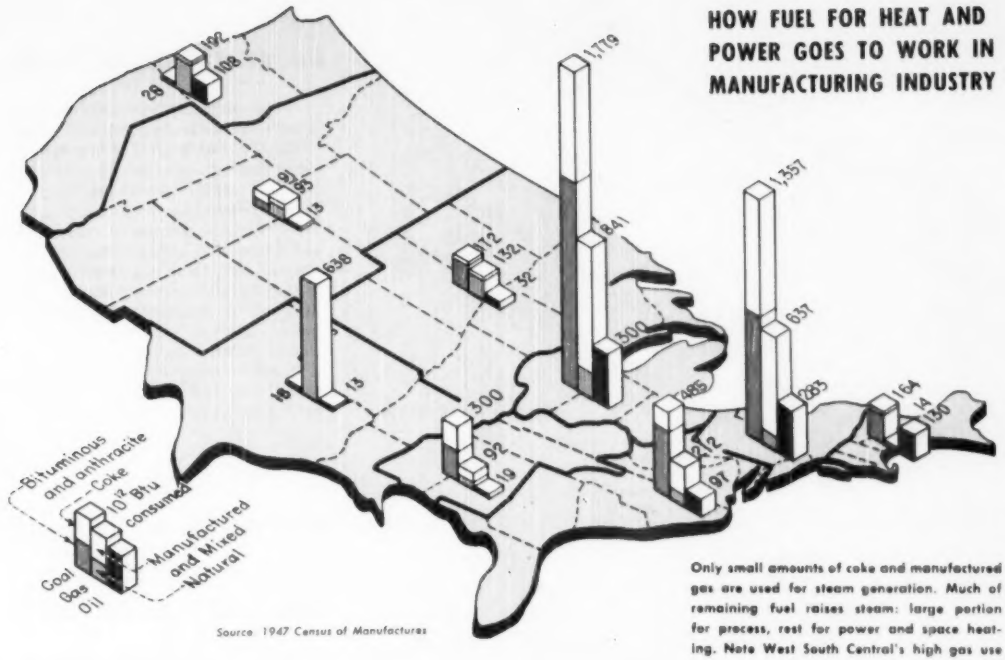
Capacity distribution for industrial units roughly parallels that of utilities. South Atlantic and New England states make most use of hydro. Bars again plotted so equal height shows annual generation of 5000 kwhr from one kw of capacity. Note intensive use of power capacity in West South Central region

INDUSTRIAL CAPACITY AND OUTPUT

Source: Federal Power Commission. Data on 4000 industrial plants. Does not include hotels, laundries, institutional plants.



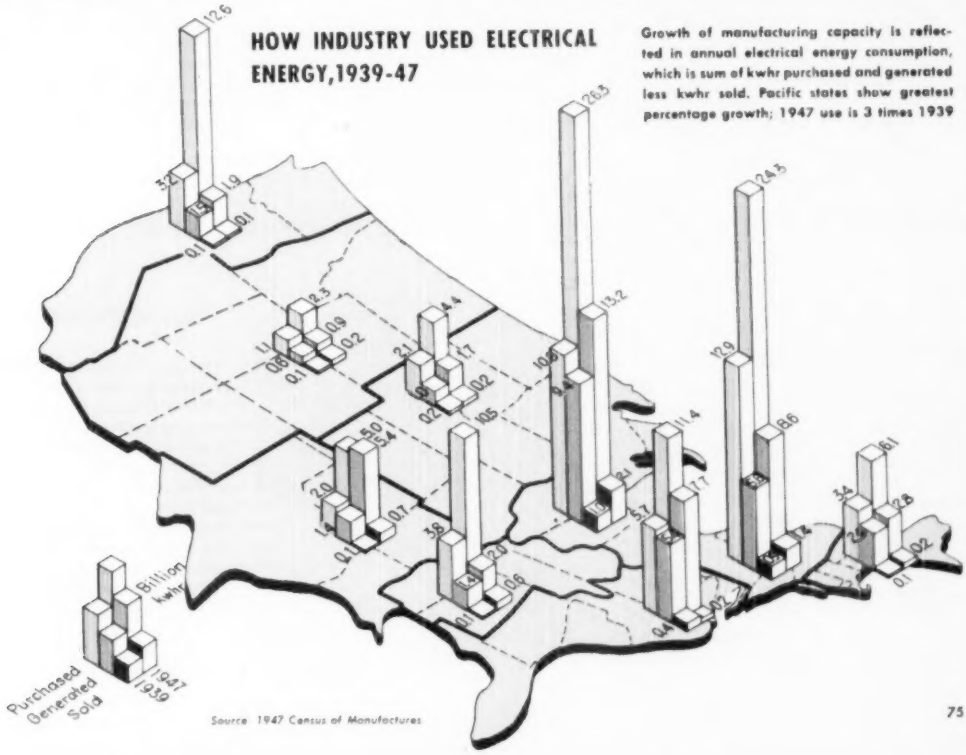
HOW FUEL FOR HEAT AND POWER GOES TO WORK IN MANUFACTURING INDUSTRY



Source: 1947 Census of Manufactures

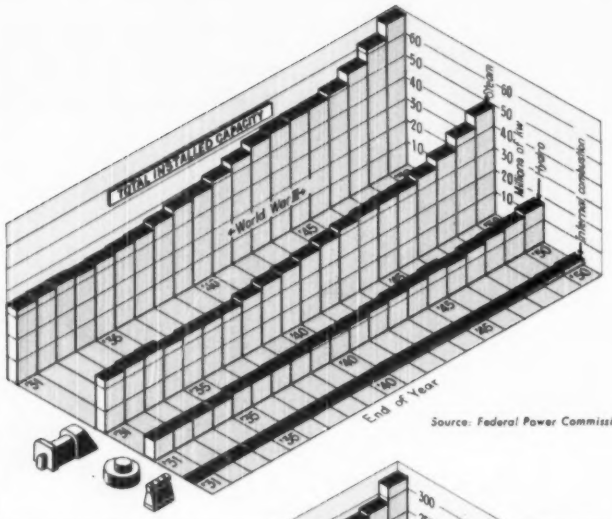
Only small amounts of coke and manufactured gas are used for steam generation. Much of remaining fuel raises steam: large portion for process, rest for power and space heating. Note West South Central's high gas use

HOW INDUSTRY USED ELECTRICAL ENERGY, 1939-47



Source: 1947 Census of Manufactures

Growth of manufacturing capacity is reflected in annual electrical energy consumption, which is sum of kwhr purchased and generated less kwhr sold. Pacific states show greatest percentage growth; 1947 use is 3 times 1939

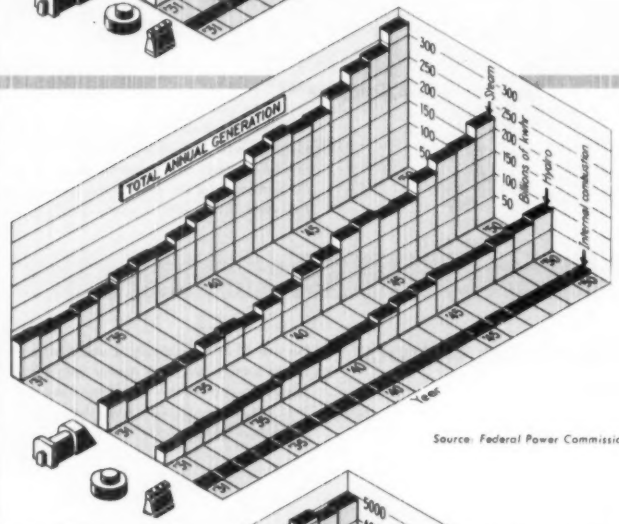


Source: Federal Power Commission

CENTRAL-STATION KW DOUBLE

In the 20 years from 1931 to 1950, total central-station capacity doubled. During World War II, from 1940 to 1946, capacity expanded by only 26%. This carefully controlled rate of growth released manufacturing capacity for ship power plants (see pp 78, 79). Since 1946, capacity has rocketed by over 36%, and right now it's growing at fastest rate in history. Most growth is in steam, with hydro slowly losing ground. Internal-combustion power, about 3% of total, is gaining.

Projected capacity additions are: over 6,100,000 kw for 1951, 8,000,000 kw for 1952, 2,600,000 kw for 1953.

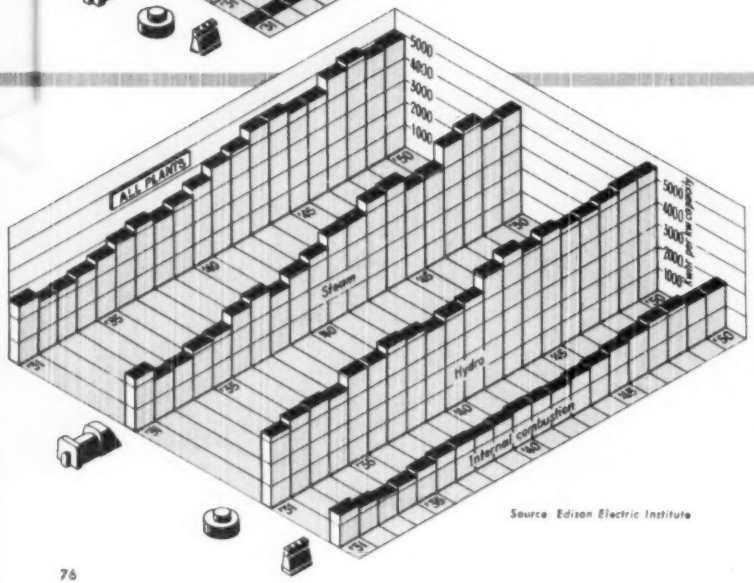


Source: Federal Power Commission

OUTPUT GROWS EVEN FASTER

While capacity growth has been amazing, it is overshadowed by phenomenal expansion in kwhr turned out. In the 20 years, 1931-1950, it has increased 3.7 times. Since more than two-thirds of total output goes to industry and commerce, this rise in demand reflects U. S. industrial growth.

Peak war year was 1944, in which output ran 61% higher than in 1940. In comparison, 1950 will be 40% higher than 1944, 225% greater than 1940.



Source: Edison Electric Institute

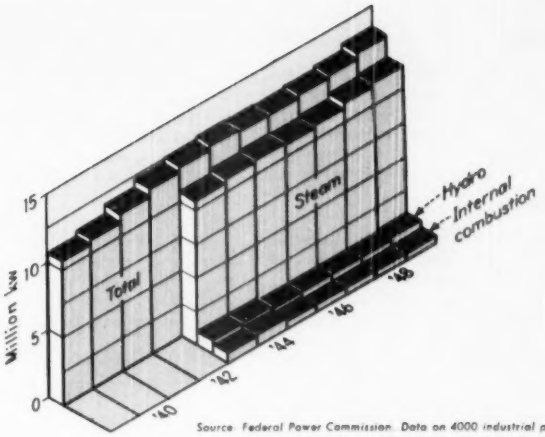
USE FACTOR RISES, TOO

If one kw of capacity runs continuously for one year, it generates 8760 kwhr. Thus kwhr per kw forms a good measure of how completely capacity is utilized. In 1931, one central-station kw produced only 2644 kwhr. By 1950, this figure had risen to 4970 kwhr. Improvement resulted from less fluctuation in daily loads, higher average loads and smaller margins of reserve.

INDUSTRIAL CAPACITY UP 32%

Industrial-plant capacity for electric generation rose from 10,575,000 kw in 1939 to about 14,000,000 kw in 1950. This is an expansion of 32%. Highest increase during war years occurred from 1941 to 1944—11,589,000 to 12,877,000 kw. This figures out to a modest 11% compared to a central-station capacity growth in the same period of 26%. Emphasis on utility expansion stemmed from basic policy decisions by war agencies (pp 78, 79).

Since 1946, industrials have expanded another 11% to keep pace with business activity. These figures do not include mechanical drive.

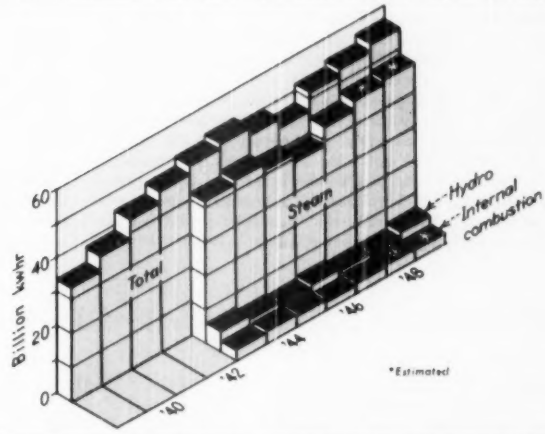


Source: Federal Power Commission. Data on 4000 industrial plants. Does not include hotels, laundries, institutional plants.

OUTPUT RISES TWICE AS FAST

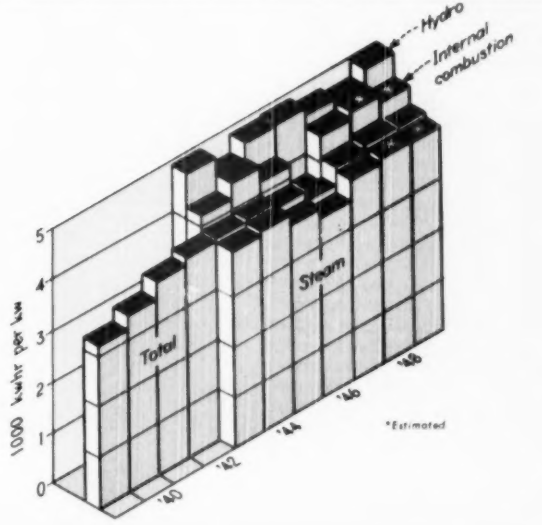
Industrial kwhr output rose from a total of 33,667,000 in 1939 to about 56,000,000 in 1950, an increase of 66%. This compares with a 255% increase in utility output for a like period.

In 1941, industrial output totaled 43,519,000 kwhr. It rose to a peak of 51,336,000 in 1944, an increase of 18%. Peacetime maximum of 1950 tops war-year peak by about 9%. Year of 1946 shows marked drop because of ending of war work and long strikes.



USE FACTOR IMPROVES

Because of specialized nature of load on industrial plants, kwhr output per kw capacity lags behind that of central stations. Despite this limitation, improvement has been made since 1939. Like those in utility systems, industry's hydro units develop more output per kw than steam units. But industry's internal-combustion engines also show higher use than steam units and their output per kw runs double that of utility engines.



How World War II's Production Drive

1940

- Power loads began to climb as defense program gained momentum; Federal Power Commission (FPC) started monthly publication of reports on capacities and loads (regional and national)

1941

- March 1: 5,750,000 kw under construction or on order for operation in 1941-42; 1,150,000 kw for 1943; 460,000 for 1944 and later
- Late Spring: Power Branch formed in Materials Division, Office of Production Management (OPM). Doubting FPC estimates of power needs, they began their own studies of war-production loads
- First Half: Big problem — planning blocks of power for expanding aluminum production
- July 1: Priority status for utility repair and maintenance equipment
- August 1: Supply Priorities and Allocations Board (SPAB) formed. Authority to restrict or curtail nonessential utility services
- Oct. 30: Limitation Order L-16 provided for mandatory integration of power-system operation, prohibition of designated uses of electricity, curtailment of power use by industry, when so ordered. First used in TVA area where drought conditions threatened power supply. Curtailment and "pooling" solved problem until December rains eased situation
- Dec. 11: First limitation on utility construction; OPM approval needed

1942

- Jan: War Time adopted. Credited with cutting peak demand 1,500,000 kw, saving 1,000,000 tons of coal annually
- March 9: General Preference Order M-76 provided for strict scheduling of turbine-generator construction. Later followed by orders covering boilers, switchgear, condensers, etc
- April: War Production Board (WPB), successor to OPM, reached agreement with FPC on power responsibilities and authority
- Spring: Shortages and threats of shortages in manpower, coal, scrap, rubber, tin, etc
- Spring: Began detailed studies of actual system capabilities. Emphasis on interconnection estimated to have saved installation of at least 1,500,000 kw

Before World War II, power was frequently singled out as the weak link in U. S. ability to produce munitions. At war's end, it stood out as the one service that met unfailingly every demand placed upon it.

This didn't just happen. It was the result of foresighted planning and cooperation among power men, and of realistic, informed direction from government agencies largely staffed with practical men from the industry. The chronology at the top of these pages gives a skeleton list of problems faced and solutions found. The lessons of experience behind these bare facts will, we sincerely hope, be used as a guide in the months and years ahead.

The following summarizes what we believe to be some of the important points — your thinking will add others.

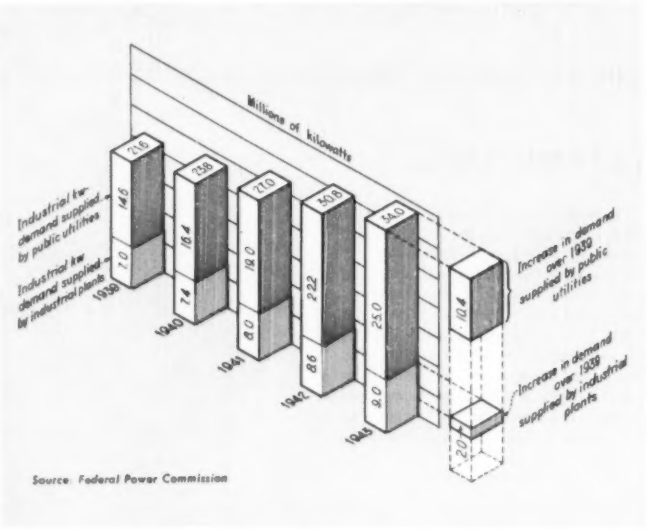
Power planning must begin early. New capacity takes longer to build, in general, than war-production facilities. Availability of power frequently determines war-plant location. A large part of the capacity with which we fought World War II was ordered before Pearl Harbor.

Estimates of power needs must take realistic account of changes brought by wartime conditions — around-the-clock operation, cutbacks in civilian industries, etc. Failure to do so was behind the "power shortage" cries that went up when early World War II estimates appeared.

PUBLIC UTILITIES SUPPLIED OVER 80% OF NEW INDUSTRIAL DEMAND

New power capacity, in general, takes longer to build than typical war-production facilities. But transmission installations can be made in roughly the same time. Hence in the power-supply planning that was such a vital part of World War II's production operations, preference went to meeting war-plant loads from existing utility systems. Further reason for this choice lay in the greater flexibility of public supply under wartime conditions of highly interconnected operation. As a general policy, then, industrial-plant power installations were normally limited to operations where steam needs were large and power could be produced as a byproduct.

Effect of this policy can be seen in the chart at the right. More than 80% of the new industrial demand between 1939 and 1943 was supplied by public utilities. To see how this demand was met with a bare minimum of new construction, look at the accompanying chart on the facing page.



Source: Federal Power Commission

Affected Power Men and Their Plants

- Spring: Started design of four floating power plants (30,000 kw). Only one used in U. S.—at Vicksburg, then Pensacola and Jacksonville. This and one other used in Europe 1944-45; third in Philippines, 1945
- May: Stop orders and priority deratings for many power projects in line with President's order to discontinue construction scheduled for completion after June 1943
- May: L-94 provided for integrated operation of all interconnected power facilities, curtailment of less-essential power loads in event of shortage. Curtailment provisions never needed
- Fall: Stop orders issued on certain Dept of Interior hydroelectric projects
- Fall: Fuel-oil shortage on East Coast led to conversion campaign by Petroleum Administration for War (PAW)

1943

- Early: Office of War Utilities formed as a semi-autonomous agency under WPB, responsible for power, communications, gas, central steam heat and water. Succeeded Power Branch
- March 19: By joint action of PAW and OWU, Amendment 50 to Ration Order 11 of OPA was issued denying fuel oil to plants where other power source or fuel was available (interconnection, conversion, etc)
- Fall: Growing shortage of coal and transportation for it. National conservation campaign started, Fuel Efficiency Council formed. "Brownout" of nonessential lighting
- Fall: Some additional capacity authorized to relieve situation created by deliberately deferred maintenance in critical period

1944

- Summer: Relaxed limitations on small generating plants
- Sept: Further relaxation to effect fuel savings, increase reserve margins
- Winter: Utility coal stocks reached dangerously low levels; fuel-conservation program continued

1945

- Winter: As material supply and shop space eased, relaxed limitations on large units—authorized about 2,000,000 kw in projects for 1946-47 installation
- Sept 30: War Time discontinued. OWU ceased operations

Conversely, in estimating power supply we must not undervalue the "stretching" that can be done by power men working in cooperation with government. Integrated operation, pooling, smaller reserves, deferred outages, all helped to make capacity go farther in the past war.

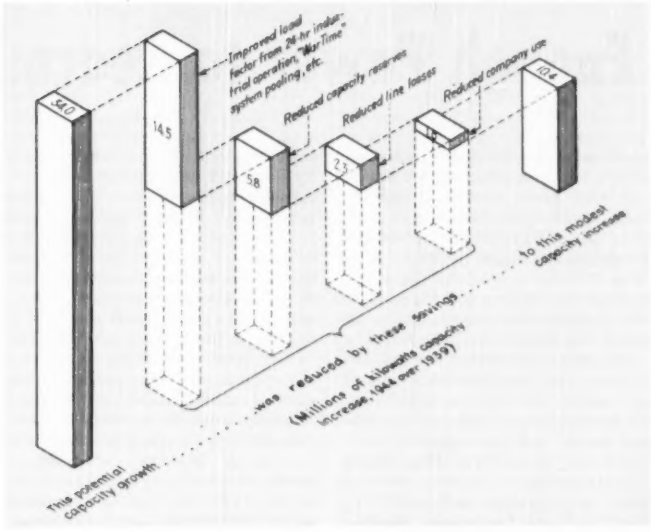
Measures to prohibit nonessential uses of electricity and curtail industrial power provide useful insurance. Such orders should be ready early, even if not needed.

It must be realized from the beginning that power plants are just as much war-production facilities as are munitions works. They should have priorities and similar protection against shortages of materials, fuel, men.

Also, we must remember that building power capacity competes with virtually all other war programs, makes big demands for copper, alloy steel, large forgings and castings. And the same shops make turbines and boilers for both power plants and naval and merchant ships.

All of which brings us to the key point: Only a centralized agency, responsible for all phases of war production, can properly fit power expansion into the over-all picture. In World War II, WPB was such an agency. Balancing conflicting claims, they were able to take the calculated risks that kept power expansion to a realistic minimum yet insured that power was never short.

HOW WAR DEMANDS WERE MET WITH MINIMUM CAPACITY INCREASE

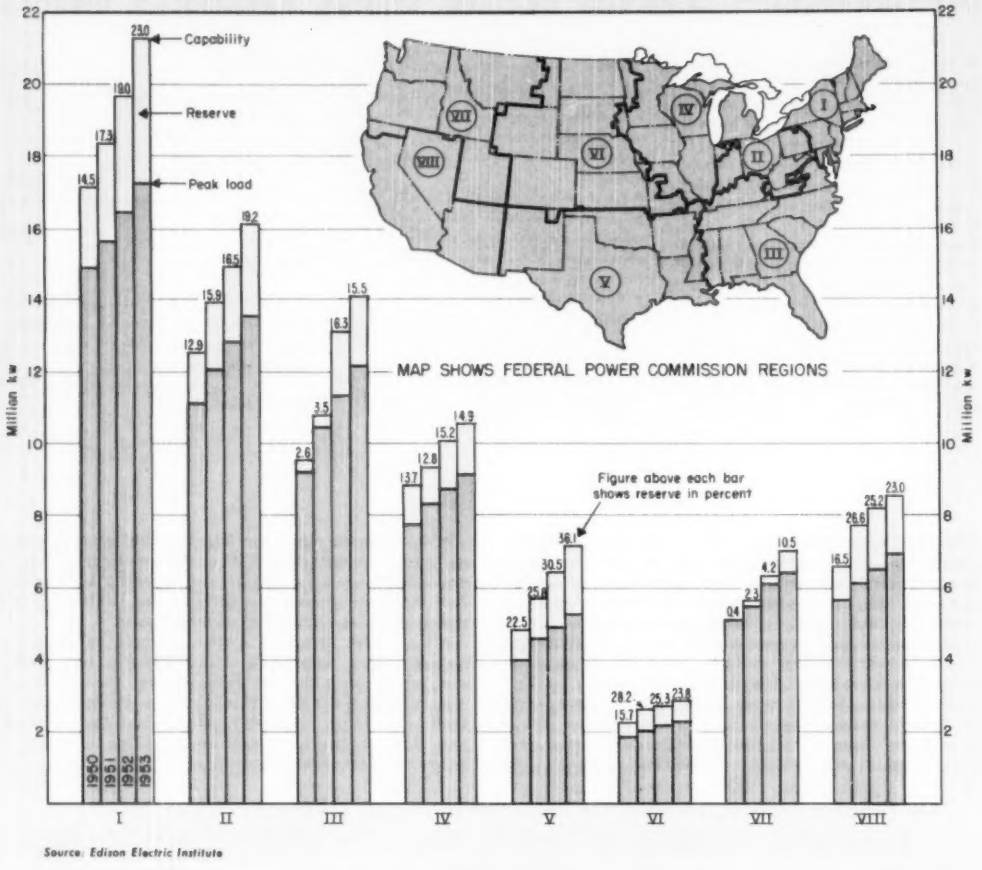


Early studies indicated need for vastly increased power capacity to meet estimated war loads. Yet such construction competed directly with other programs for scarce materials and, in particular, with the Navy and merchant marine for turbines, boilers.

WPB took a carefully calculated risk and cut power-system expansion to the bone, releasing materials and shop facilities for other programs. It did so in the confident belief that (1) around-the-clock industrial operation and War Time would hold peak demands below early predictions (2) power men could "stretch" capacity by pooling, by cutting losses and reserve margins (3) in an emergency, nonessential uses could be cut.

The chart shows their confidence was not misplaced. Had all stayed the same as prewar, 34,000,000 kw of new capacity would have been needed for war loads. We actually did the job, without once failing, with less than one-third that—10,400,000 kw.

ESTIMATED CAPABILITIES, PEAKS AND RESERVE MARGINS, 1950—1953



Source: Edison Electric Institute

Will There Be Enough Power to Rearm?

With the mobilization program barely under way, we already have a situation reminiscent of the early days of World War II. Federal agencies then raised a cry of "power shortage," asked greatly stepped-up expansion of the nation's power facilities (see pp 78, 79). Officials of the recently formed Defense Power Administration (DPA) now cast doubt on the adequacy of today's power-system expansion. The electric-power industry, with a record of being right on questions of this kind, says power supply will be ample to meet all foreseeable needs. Let's take a look at the available facts.

EEI Reports. As this issue of POWER goes to press, the Electric Power Survey Committee of the Edison Electric Institute is putting finishing touches on its 8th semiannual report. Charts and table above summarize preliminary figures; final data should differ but little. These semiannual reports consist of two major parts: (1) forecasts of system capabilities, peak loads and reserve margins, and (2) summaries of orders and manufacturing capacity for heavy power equipment.

To prepare capability and load estimates, the Committee canvasses all companies and agencies contributing to the public power supply—private utilities, federal and state agencies, municipals and cooperatives. Their respective estimates of capability and peak load are combined and totaled by Federal Power Commission Regions. Data of chart above represent about 95% of total public power supply.

Capability. In studying results of this survey, bear in mind that all supply figures are in terms of *capability*. This differs from nameplate rating by (1) any difference between actual ability of a given unit to produce and its nameplate rating (2) effect of system interconnections, which because of diversity tend to increase ability of a given group of units to meet a peak load. In other words, we are comparing a realistic estimate of ability to handle demand with a carefully estimated peak load. Difference, of course, is margin of reserve, shown by bar heights in the chart above and also expressed as percent of peak load. Note that es-

CURRENT SHIPMENTS AND ORDERS BOOKED FOR HEAVY POWER EQUIPMENT

Large Steam Turbine-Generators (10,000 kw up)

Total capacity shipped, or on order and scheduled for shipment	Kilowatts 1950	1951	1952	1953
For continental U. S. utilities	4,913,500	4,939,500	6,686,000	2,161,000
For continental U. S. industrials	130,000	332,500	182,500	.....
For outside continental U. S.	243,500	933,000	90,000	.....
Total	5,287,000	6,205,000	6,958,500	2,161,000
Estimated open manufacturing capacity for production of additional units	.....	100,000	700,000	5,500,000
Current delivery time	10,000–60,000 kw, 14 to 27 mo; 60,000 kw up, 27–35 mo.			

Small Steam Turbine-Generators (4000 to 9999 kw)

Kilowatts 1950	1951	1952	1953
185,500	91,000	.....	.....
81,000	239,500	.....	.....
33,700	13,500	.....	.....
300,200	344,000	.....	.....
.....	490,000	1,200,000	1,200,000
4000–9999 kw, 9 to 12 mo.			

Steam Generators (450 psi and over)

Total capacity shipped, or on order and scheduled for shipment	M lb steam per hr 1950	1951	1952	1953
For continental U. S. utilities	47,183	56,080	19,199	.....
For continental U. S. industrials	11,050	12,642	400	.....
For outside continental U. S.	8,590	11,112	.....	.....
Total	66,823	79,834	19,599	.....
Estimated open manufacturing capacity for production of additional units	.....	32,000	131,000	150,000
Current delivery time	4 to 16 months (shipment of drum)			

Water-Wheel Generators (4000 kw up)

Kilowatts 1950	1951	1952	1953
974,865	1,090,145	1,293,235	488,260
.....	.....	.....	.....
293,800	495,940	63,950	.....
1,268,665	1,586,085	1,357,185	488,260
.....	100,000	840,000	1,710,000
Small physical size, 18 to 24 mo; large, 24 to 30 mo.			

Hydraulic Turbines (5000 hp up)

Total capacity shipped, or on order and scheduled for shipment	Horsepower 1950	1951	1952	1953
For continental U. S. utilities and industrials	1,833,740	2,093,750	1,456,250	430,400
For outside continental U. S.	229,700	324,900	39,000	.....
Total	2,063,440	2,418,650	1,495,250	430,400
Estimated open manufacturing capacity for production of additional units	.....	1,100,000	2,600,000	3,600,000
Current delivery time	Small physical size, 10 to 18 mo; large, 14 to 24 mo. (Shipment of operating parts)			

Power Transformers (501 kva up)

Kva 1950	1951	1952	1953
32,226,000	20,267,000	4,797,000	377,000
1,506,000	2,408,000	128,000	.....
33,732,000	22,675,000	4,925,000	377,000
300,000	22,000,000	40,000,000	45,000,000
Small size units, 2 to 14 mo; large, 5 to 24 mo.			

NOTE: Facing charts and table above are based on preliminary results of EEI's 8th semiannual survey of electric power requirements. See EEI report for final data

timates of capability for hydro systems are based on median water conditions.

Reserve Margins. In all but two regions, reserve margins for the three years ahead run better than 12% in all cases, and in most areas are over 15%. The two tight spots are the Southeast (Region III) and the Northwest (Region VII). In Region III, indicated margins for this year and next are only 2.6 and 3.5%, respectively, but will climb to better than 15% by 1952. Forecasts indicate better than median water conditions this year so margin may prove safer than chart shows.

Outlook is worse in Northwest, specifically in the western division of this region. There a deficit of 2.1% is shown for this year, but better than median water conditions are expected. The reserve margin moves over to the plus side by small amounts in 1951 and '52, rises to 7.7% in 1953.

While national totals have little real significance, they do serve to give some idea of over-all size of our present power-system expansion. By the end of this year, some 6.7 million kw of capability will have been added. About 7.7 million kw will be added in 1951 and in '52. Figure for 1953 looks to be about 6.5 million. Increase in capability over the next three years represents about one-third of total capacity at end of 1950.

Equipment Orders. Another view of the expansion now under way can be gained from the tabulation above, which summarizes heavy power equipment shipped or scheduled for shipment this year, and booked for shipment in the next three years. Some totals will give an idea of the way records are being broken:

(1) In six months following April 1, 1950, 8.6 million of new capacity was ordered. (2) In the next three years, more than 13 million kw of new central-station steam equipment will be shipped. This is 28% of capacity installed at end of 1950. (3) Over 2.8 million kw of central-station hydro capacity will be delivered in the same period, 16% of 1950 capacity. (4) Total new capacity for central stations in 1951-53 comes to 16.75 million, 24% of total capacity at end of 1950. (5) While no new industrial hydro capacity is yet scheduled, industry will expand its steam plants by about 0.75 million kw in the next three years (units of 4000 kw and up).

Manufacturing Capacity. The survey indicates a total manufacturing capacity for heavy power equipment of about 10 million kw per year, of which about 8 million is steam and 2 million is hydro. Table shows "open" manufacturing capacities for the several items of equipment for years 1951 through 1953. In evaluating these, bear

FUELS...

Situation at a Glance

COAL

• **PRODUCTION** this year will run about 500 million tons, well below 1947 peak of 631 million. Full use of today's facilities would certainly yield 600 million and quite possibly 650 million tons annually.

• **STEP-UP** in mechanization, assuming machinery and materials remain available, could boost annual output to 800 million tons in three to five years.

• **NO SHORTAGE** of coal thus seems likely. But coal at the mines won't make either steam or steel. So . . .

• **TRANSPORTATION** may be the bottleneck. It's already tight. Since July 1, cars have been short of needs by as much as 8500 hoppers and 7000 gondolas per day.

• **STOCK-PILING** looks like a wise policy. Get coal when load on mines and railroads is seasonally light, store it for tight times.

OIL

• **RESERVES** are at highest level yet, adequate to supply present or higher production.

• **REFINERIES** are now handling crude at a rate of about 6,000,000 bbl per day. This could be upped by about 10% in a relatively short time. Expansion is now under way but more may be needed if demand continues to grow at present rate.

• **DIESEL-FUEL** supply, stocks seem adequate on over-all basis. Big future question mark is demand for jet fuels, likely to come out of the same "cut." Present use of jet fuels is small, doesn't materially affect picture.

• **BUNKER OIL** may be tight on East Coast. Price drop in 1949 and coal strikes boosted use, so supply barely keeps pace with demand. Stocks are low. Increased demand on West Coast may cut tanker shipments to East. Imports can be increased but tight situation is likely to continue. Since many users switched from coal, short supply of residual is not likely to be a substantial problem.

GAS

• **PIPELINES** have been greatly extended and capacity raised. With ample reserves, pipelines are only limitation on supply. Gas is thus strictly a . . .

• **LOCAL PROBLEM.** With many industrial users on "dump" contracts and geared to swing to other fuels, any local shortages are not likely to have a serious effect.

in mind the current delivery schedules indicated. Thus, although there is nominal open capacity for about 100,000 kw of large steam turbine-generators in 1951, delivery schedules indicate that orders placed today will be scheduled for 1952 or '53 delivery, depending on size.

We Start Ahead. Before trying to assess adequacy of power expansion revealed by these figures, we should stop a moment to grasp the over-all significance of the EEI reports and the cooperative effort they represent. We started mobilizing for World War II without facts of this kind. Only after initial fumbling did we get realistic capability estimates and scheduled manufacturing. And it was only when we did that sound power planning became possible.

We thus stand today, at the beginning of a new mobilization program, at a point we reached only after painful experience the last time. More important, we have available to us the skills and wisdom gained in those days, in the persons of experienced power-system operators and executives. Given opportunity to devote that experience to problems ahead, they should be able to better the job of World War II, when production was never slowed by lack of power.

Enough Power? Now, then, are the indicated margins big enough? Right at the start, let's realize that not much can be done about 1951-52. We're committed to that program for better or worse. So we're talking about 1953 and beyond. Biggest question mark, of course, is effect of "war" loads. EEI estimates of peaks include all known or expected loads of this kind. Yet it is evident that much of DPA's concern over power supply stems from defense needs on which information, in their own words, is "fragmentary." In the wind, for example, are projected big demands for a 2-billion-lb-per-yr capacity increase in aluminum, talked-of expansion in magnesium production, and growth in the atomic-energy program, already taxing TVA's output.

Aluminum Program. Projected aluminum expansion forms a good case in point. To produce an additional 2-billion lb per year would require something over 2 million kw of power capacity. Assuming this expansion is planned over a 3-yr period, this means picking up about 700,000 kw of new capacity annually. This is not large in terms of total expansion now under way. The hitch is the location of the aluminum plants. If we insist on "cheap" power and don't include Canada's possible contribution of roughly half a billion lb per yr, we face the job of finding needed new capacity in hydro areas already tight or in regions where cheap fuel is available.

Thus the aluminum power-supply question boils down to how many strings are attached. If, as we wisely decided in World War II, we let power cost go by the boards and put plants where power is available, then finding needed capacity shouldn't be too hard. The more strings, the harder it gets.

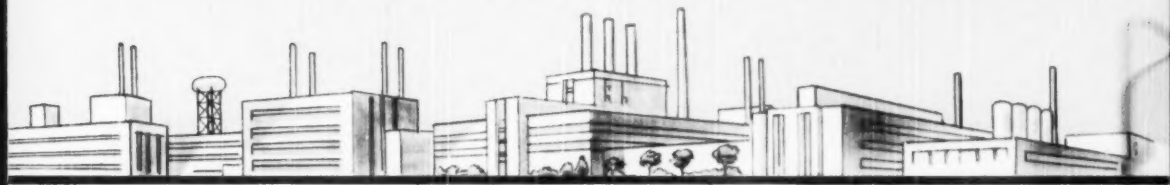
War-Load Lessons. In all thinking about war loads, some lessons of the past bear repeating again and again: (1) War loads do not add on top of civilian loads, they tend to displace them. Civilian industry took about 8 billion kwhr per month in midyear 1940. War load reached a peak of about 11 billion kwhr per month at end of 1943. (Of this about 2.3 billion was for aluminum and magnesium.) Total industrial load did not reach 19 billion, but only about about 14.5 billion, because by end of 1943 civilian-industry use had shrunk to only 3.5 billion. (2) War kwhr loads do not proportionately increase kw demand, because around-the-clock 7-day operation and other shifts boost kwhr output of each kw of capacity. (3) War loads do not affect power systems immediately. A plant on paper consumes no energy. Rate of conversion from civilian to war industry is usually controlled by availability of manpower, materials and manufacturing facilities. (4) Under stress of war conditions, available capacity can be "stretched" to a great extent.

Power Not Alone. And finally, we must remember that power is not the only element of the problem. If it were, the answer would be simple — build all the new capacity we can, as fast as we can. That isn't the answer for several reasons: (1) For the peacetime good of the nation, we should aim at building a power system bearing some reasonable relation to future peaceful needs. (2) Even assuming this consideration carries no weight in an "all-out" drive for national security, we still cannot go overboard on power. Power expansion competes for materials and manufacturing facilities with other parts of our effort, parts that may be even more important in the total picture. That was a ruling consideration in World War II's power program and it is likely to be again.

What then is the answer? The plain fact is that there is no answer now. We just don't have all the facts. Working with the facts we have, the power industry has set up its program. On the basis of those facts, it should do the job. As new facts develop, power men are ready with the skill and experience to modify that program to meet new needs. We did the job once, we're even better prepared to do it again.

New Power Plants Put Muscle Into U. S. Rearmament Program

We'll get under way on power from plants now operating but for the big push we'll need output of many units now on drafting boards or under construction. To show you how these new power sources shape up, our 1950 Modern Plant Survey lists technical features of over 500 central-station and industrial steam units, 150 hydro stations



How to Use Survey Facts Most Effectively

The following pages bring you the most complete data available anywhere on the design features of steam and hydro units planned, under construction and starting operation. But because of the way we must compile the facts, the survey does *not* include *all* current programs nor does it consist entirely of strictly current construction. Here we tell you briefly how the job is done, and point out specific limitations of the listings, all with the idea of helping you to use the facts most effectively.

● **HOW WE DO THE JOB.** As a continuing service, POWER's editors assemble news of installations planned or ordered. From these records, questionnaires are mailed to the individual companies, asking details of their projects. The replies form the basis for the tables, which are compiled at approximately yearly intervals.

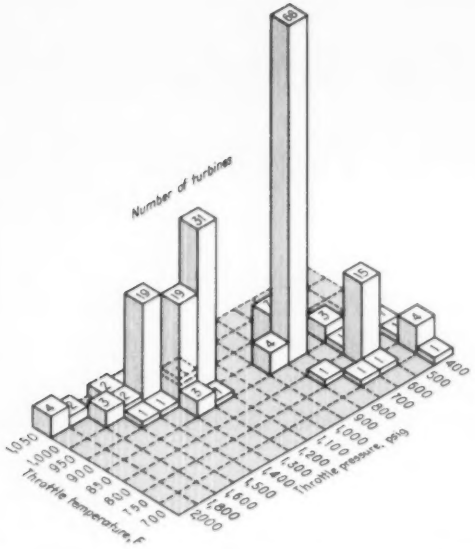
● **ITS LIMITATIONS.** It can be seen that, in the nature of things, these tabulations cannot be complete. Nor can the published list correspond exactly in point of time with actual installations or announcements of them. If engineering is done a long time ahead of construction, data may appear in the tables well before start of plant construction.

On the other hand, many installations do not appear in the tables until long after the plans are widely known. This simply means we're waiting for engineering to progress to a point where the plant owner can supply full technical information. In such cases, we keep after the job and when the data become available they are listed. Each set of tables is checked against preceding ones to avoid any duplication of listings.

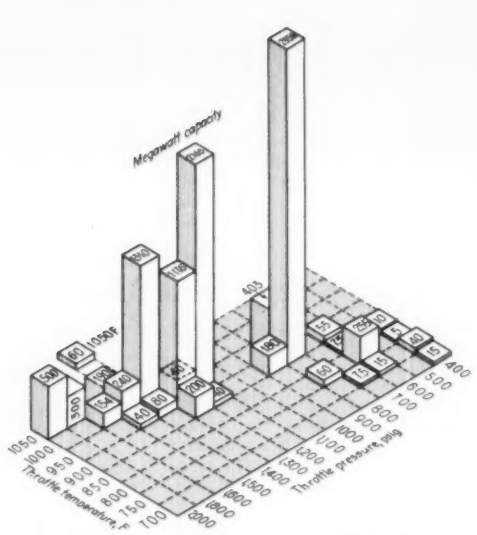
● **HOW TO USE SURVEY.** Being *representative* of design and construction work in progress at the end of 1950, the following tables yield useful information on general trends. We have charted some of these technical trends for your convenience on pp 84, 85, 90, 91 and 101.

And, of course, the tables are highly useful for satisfying your curiosity about details of specific central-station or industrial installations.

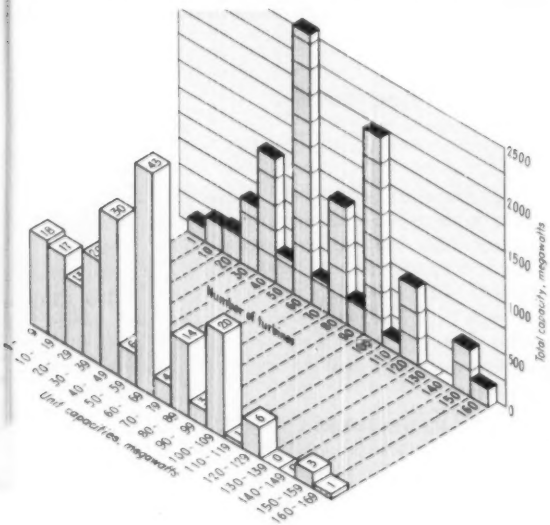
● **HOW NOT TO USE IT.** Remember these are not complete lists, only extensive samples. **Do not use the survey facts to arrive at total figures on capacities, sales, etc, or to make comparisons where lack of completeness will distort the results.**



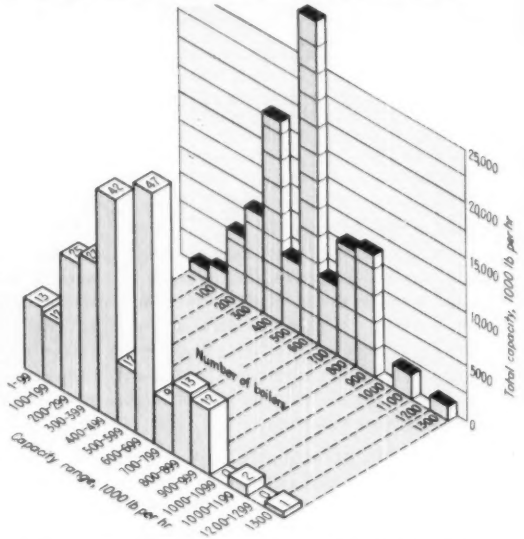
1 One-third of units use 800-psig 900-F steam, one-sixth 1200-psig 950-F; 46% use 1200-psig or higher pressure



2 In capacity terms, 27% use 800-psig 900-F steam, 21% 1200-psig 950-F; 61% 1200-psig pressure and higher



5 Turbine-generators in 60-69 mw range again predominate both in number of units and in total megawatt capacity



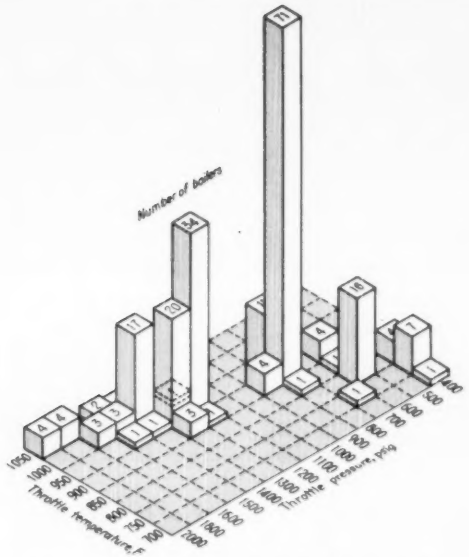
6 Boilers in 600,000-lb-per-hr range predominate in number of units and total capacity, paralleling turbine spread

Trends in Utility Plants

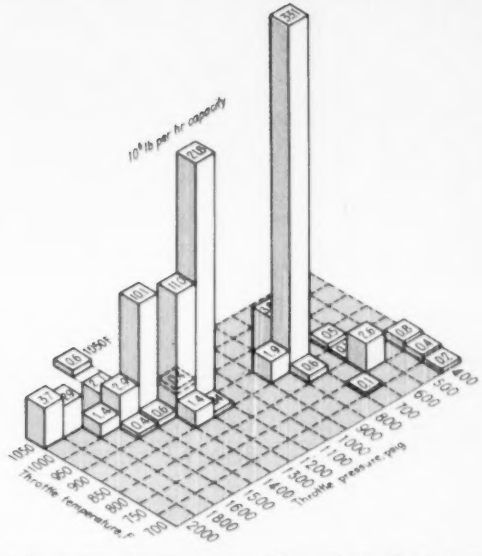
About 10,100,000 kw of steam capacity will start operating during 1950 and 1951. Almost 9,000,000 kw is scheduled for delivery during 1952 and later. Fig. 1 to 9 summarize installations starting 1950 and later. They include about 91% of steam capacity for 1950-51 and about 14% of capacity for 1952 and later. Municipal and cooperative-system stations are excluded.

For details on all these installations refer to the surveys appearing in June 1947, October 1948 and September 1949, as well as the current survey appearing on the following pages.

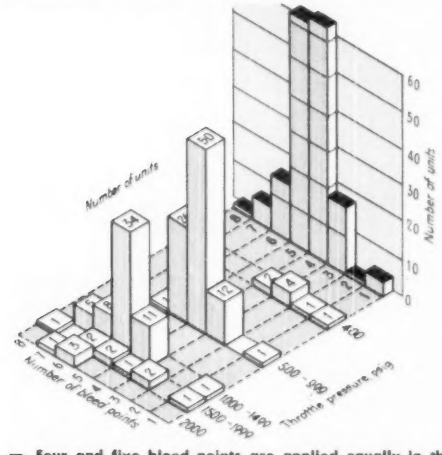
Reheat Units. Fig. 1 to 9 include 32 units that will use reheat. They have a total capacity of 2,650,000 kw. Reheat temperatures vary from 835 to 1000 F. It appears that reheat cycles will be increasingly accepted for large units in the future.



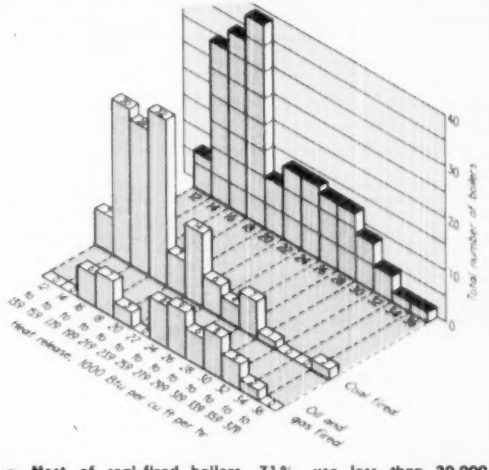
3 Because of large number of single-boiler-per-turbine installations, boiler distribution parallels turbine trend



4 Comparing with Fig. 2, note fairly uniform lb of steam per kw capacity regardless of throttle steam conditions



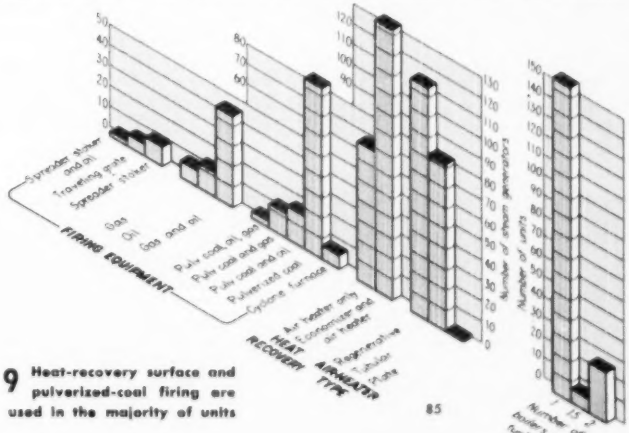
7 Four and five bleed points are applied equally in the new installations; previously four points were the most used



8 Most of coal-fired boilers, 71%, use less than 20,000 Btu per hr per cu ft heat release. Stokers range higher

Higher steam conditions are leading to using a greater number of bleed points. For the first time, Fig. 7, four bleed points are not predominant. The current tally shows an equal number of units using five points. Larger number of bleeds are also finding increasing use.

Of the units reported on the following pages only three are completely outdoor and nine semi-outdoor in arrangement. Two installations will use rotary pumps for condenser air removal, one will use a piston pump and the remainder will use conventional steam-jet air ejectors.



9 Heat-recovery surface and pulverized-coal firing are used in the majority of units

1950 Design Survey of Typical New

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers	First operation, new units	Nominal pressure, psig	Nominal temperature, F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Boiler, waterwall surface, 1000 sq ft	Superheater surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr
1500 PSIG AND ABOVE													
Indiana & Michigan Electric Co	Lawrenceburg, Ind.	Tanners Creek	Amer. Gas & Elec Co.	1-51[1]	2000	1050[2]	1	930	BW	31.0	95.9[3]	79.8	16.4
Consolidated Edison Co of N. Y.	Astoria, Queens, N.Y.	Astoria		12-52 4-53	1800	1000[2]	2	1200	BW	22.7	35.0	93.0	17.0
Central Hudson Gas & Elec Corp.	Danskammer Pt, N.Y.	Danskammer	Burns & Roe, Inc	1-52[1]	1650	1000[2]	1	500	CE	20.5	32.4[3]	27.2	22.5
Jersey Central Power & Light Co	South Amboy, N.J.	South Amboy	Burns & Roe, Inc	12-52	1650	1000[2]	1	475	BW	15.0	37.6[3]	12.7	45.2
Wisconsin Electric Power Co				12-52	1575	1000[2]	1	795	CE	37.3	18.3[3]	102.0	10.4
Long Island Lighting Co	Glenwood Land'g, NY	Glenwood No. 3	Ebasco Services, Inc	1952	1525	1000[2]	1	750	CE	33.1		62.0	16.1
Public Service Elec & Gas Co	Sewaren, N.J.	Sewaren		1951	1500	1050[2]	1	822	CE	18.2	69.1[3]	67.8	16.5
1000 TO 1499 PSIG													
Toledo Edison Co	Toledo, Ohio	Acme	G W Saathoff	1951	1450	1000	1	650	BW	21.7	32.6	47.4	16.9
				2-49	820	950	2	500	BW	39.5		49.5	16.3
Cincinnati Gas & Elec Co	New Richmond, Ohio	Clermont	Electric Advisers, Inc	3-52	1450	1000[2]	1	706	CE	36.0	70.3[3]	64.2	14.7
Central Illinois Publ Service Co	Hutsonville, Ill.	Hutsonville	Sargent & Lundy	1952	1450	1000[2]	1	525	CE				
Virginia Electric & Power Co	Wheelwright, Va.	Chesterfield	Stone & Webster	5-52	1450	1000[2]	1[4]	750	CE	34.8	46.0	39.0	26.0
Carolina Pwr & Light Co	Lumberton, N. C.	Lumberton	Ebasco Services Inc	6-52	1450	1000[2]	1	550	CE	26.1	35.0	39.0	18.6
Carolina Pwr & Light Co	Goldsboro, N. C.	Goldsboro	Ebasco Services Inc	6-52	1450	1000[2]	1	550	CE	26.1	35.0	39.0	18.6
Niagara-Mohawk Pwr Corp	Nr Albany, N. Y.	Albany		1952	1450	1000[2]	2	675	CE	32.8	42.3	58.0	15.8
New York State Elec & Gas Corp	Johnson City, N. Y.	Goudey	Gilbert Associates Inc	1951	1450	1000[2]	1	560	CE	29.3	43.7[3]	44.6	17.0
Illinois Power Co	W. of LaSalle, Ill.	Hennepin	Sargent & Lundy	10-53	1450	1000[2]	1	525	CE				
Florida Power & Light Co	Nr Miami, Fla.	South Florida	Ebasco Services Inc	8-52	1450	1000[2]	1	550	CE	26.1	35.0	39.0	18.6
Potomac Electric Power Co	Washington, D. C.	Benning	Stone & Webster	1952	1450	1000	1	675	CE	30.7		55.4	14.4
Duke Power Co	Mt. Holly, N. C.	Riverbend		5-52	1300	950[5]	1	810	CE	40.5	44.3[3]	68.0	15.6
				7-52	1300	950[5]	1	810	CE	40.5	44.3[3]	68.0	15.6
Duquesne Light Co	Elrama, Pa	Elrama		12-51	1300	950	1	860	BW	28.9	35.1	69.8	
Iowa Power & Light Co	Des Moines, Iowa	Des Moines, No. 2	United Lt & Rwy Serv United Lt & Rwy Serv Black & Veatch	8-48	1290	925	1	375	CE	18.0	13.5	24.5	19.0
				5-49	400	750	...						
				12-50	1290	925	1	375	CE	27.1	14.5	25.2	18.4
Texas Electric Service Co	Fort Worth, Texas	North Main	Ebasco Services, Inc	3-52	1250	955	1	775	CE				
Wisconsin Power & Light Co	Sheboygan, Wis	Edgewater	Sargent & Lundy	6-51	1250	950	1	660	BW	13.2	31.1	24.1	30.0
Georgia Power Co	Yates, Ga	Yates	Southern Services, Inc		1250	950	1	975	CE	40.9	36.2	74.0	15.4
Columbus & S. Ohio Elec Co			Ebasco Services Inc	1953	1250	950	1	650	CE	27.0		44.0	18.0
Minnesota Power & Light Co	Aurora, Minn	Aurora	Ebasco Services Inc	3-53	1250	950	2	425	CE	15.7	16.2	31.0	17.9
San Diego Gas & Electric Co	San Diego, Calif	Silver Gate	Pioneer Serv & Engrg	8-50	1250	950	1	575	BW	9.7	21.0	25.0	28.7
Pennsylvania Electric Co	Erie, Pa	Front St	Gilbert Associates, Inc	7-52	1250	950	2	400	CE	19.2	25.7	25.5	19.6
Florida Power Corp	Oldsmar, Fla.	Booth Point	Kuljian Corp	5-51	1250	950	1	450	BW			26.0	
				1953	1250	950	1	450	BW			26.0	
	Avon Park, Fla.	Avon Park	Kuljian Corp	7-52	1250	950	1	450	BW			26.0	
	St. Petersburg, Fla.	Baybaro	Kuljian Corp	12-49	850	900	1	330	BW	21.9			24.3
800 TO 999 PSIG													
Northern States Power Co	Minneapolis, Minn	Riverside	Pioneer Serv & Engrg	7-50	900	900	1	570	BW	13.5	22.9	37.5	20.0
		Black Dog	Pioneer Serv & Engrg	6-52	850	950	1	600	CE	17.4	21.0	43.3	17.6
New York State Elec & Gas Corp	East Corning, N. Y.	Hickling	Gilbert Associates, Inc	4-51	850	900	1	300	BW	23.3	10.6	21.0	17.6
Eastern Shore Publ Service Co	Vienna, Md.	Vienna	United Engrs & Constr	1952	850	900	2	220	BW	24.4	8.7	12.5	22.4
Hydro-Elec Pwr Comm of Ontario	Toronto, Ont.	Richard L Hearn	Stone & Webster	11-51	850	900	2	850	BW	49.1	18.8	69.6	15.5
	Windsor, Ont.	Windsor	H G Acres & Co	9-51	850	900	2	650	BW	44.4	17.6	52.5	15.0
Union Electric Power Co	Venice, Ill.	Venice No. 2	Stone & Webster	10-50	850	900	1	900	BW	29.0	29.2	83.8	13.7
				12-50	850	900	1	900	BW	29.0	29.2	83.8	13.7
Southern California Edison Co	Redondo Beach, Calif.	Redondo	Stone & Webster	1949	850	900	3	400	BW	7.3	14.8	13.9	39.0
Hartford Electric Light Co	Hartford, Conn.	South Meadow	Stone & Webster	4-50	850	900	1	450	BW	25.7	14.4	38.4	14.7
Public Service Co of Colorado	Denver, Colo.	Arapahoe	Ebasco Services, Inc	10-50	850	900	1	450	BW	33.1	19.8	41.9	14.3
				4-51	850	900	1	450	BW	33.1	19.8	41.9	14.3
				1952	850	900	1	450	BW	33.1	19.8	41.9	14.3
Alabama Power Co	Chickasaw, Ala.	Chickasaw	Southern Services, Inc	1951	850	900	1	425	CE	27.2	10.5	21.2	24.0
Mississippi Power Co	Hattiesburg, Miss.	Eaton	Southern Services, Inc	8-49	850	900	1	230	RS	20.2	7.8	14.8	20.2
	Meridian, Miss.	Sweatt	Southern Services, Inc	3-51	850	900	1	425	BW	9.9	10.4	22.3	24.3

A – Air cooled
AAd – Arsenical Admiralty
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
AdI – Admiralty, inhibited
AlB – Aluminum-bronze
AlBr – Aluminum-brass
AsAd – Antimony-Admiralty
An – Anthracite
AsAd – Arsenical Admiralty

AsCu – Arsenical copper
BW – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion Engineering-Superheater, Inc.
CP – C A Parsons
CuNi – Copper-nickel
Cy – Cyclone furnace
D – Damper
DB – Dry bottom

DL – DeLaval Steam Turbine Co
EC – Erie City Iron Works
EE – English Electric
El – Elliott Co
EW – Edge Moor Iron Works, Inc
FW – Foster Wheeler Corp
G – Natural gas
GE – General Electric Co
H – Hydrogen cooled
Hy – Hydraulic coupling

L – Lignite
M – Motor drive
Ma – Magnetic coupling
MI – Murray Iron Works Co
Mp – Two motors per fan
MT – One motor, one turbine per fan
Mu – Muntz metal
O – Oil
P – Pulverized coal fired
PAd – Phosphorized Admiralty

Steam Central-Station Installations

Furnace bottom	Economizer surface per boiler, 1000 sq ft	Air-heater surface per boiler, 1000 sq ft	Air-heater type	F-D FANS: Drive	F-D FANS: Air-flow control	I-D FANS: Drive	I-D FANS: Gas-flow control	Firing	FUEL: Type	FUEL: Heating value, 1000 Btu per lb	FUEL: Ash-softening temperature, °F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of bleed points	Generator cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity incl new units, 1000 lb	Total generator capacity incl new units, 1000 kw
DB	16.4	281.4	Re	M	V	M	V	P	C	11.4	2300	3M	R	150	3600[16]	GE	0.79	7	H	65.0	1	AsCu	930	150
DB	25.1	456.6	Re	M[25]	V	.....	.....	P, O, G	C, O, G	.....	2050	3M	R	{160	3600	WE	0.5	7	H	105.0	1	AlBr	2,400	320
														{160	3600	GE	0.5	7	H	105.0	1	AlBr		
DB	13.5	83.5	Tu	M	D, V	M	D, Hy	P	C	13.3	2300	2M	Hy	60	3600	GE	0.5	6	H	46.6	1	Ad	500	60
ST	0	166.6	Tu	M	V	.....	D	Cy, O	C, O	13.0	2300	2M	Hy	50	3600	GE	0.5	6	H	40.0	1	Ad	1,225	105
DB	34.0	284.4	Re	M	S	M	S	P	C	12.4	.....	2T	S	120	3600[10]	AC	0.5	6	H	85.0	1	Adl	795	120
DB	9.0	79.8	Re	M[12]	D	M[12]	D	P, O, G	C, O, G	13.5	2500	3M	S	100[6]	3600	GE	1.25	5	H	60.0	2	AlB	2,750	272
ST	17.8	169.0	Re	M	S, Hy	M	D	P, O, G	C, O, G	13.2	2050	3M	S, Hy	125[5]	3600	WE	0.75	8	H	65.0	1	AlBr[9]	3,372	455
DB	10.0	198.0	Tu	M[12]	V	M[12]	V	P, G	C, G[18]	12.3	2000	2M, 1T	S	60	3600	GE	0.5	7	H	45.0	2	PAd	.....	.....
DB	0	103.0	Tu	M[12]	V	M[12]	V	P	C	12.3	2000	3M, 2T	S	90	3600	WE	0.5	7	H	70.0	2	PAd	.....	.....
DB	9.5	192.6	Re	M	D, V	M	D, Ma	P	C	13.0	2500	3M	R, Hy	100	3600	WE	0.5	5	...	55.0	2	AsCu	706	100
DB	.....	.....	Re	M	V	M	Ma	P	C	11.3	2000	2M	Hy	60/75	3600	GE	0.5	4	H	55.0	2	AsCu	1,125	130
DB	21.4	136.0	Re	M[12]	V	M[12]	V	P, O	C, O	13.0	2300	3M	Hy	90	3600	GE	0.75	5	H	65.0	2	AAd	1,925	200
DB	14.8	149.4	Re	M	D	M	D	P	C	13.8	2100	2M	R	66	3600	GE	0.75	5	H	50.0	2	AsCu	1,400	154
DB	14.8	149.4	Re	M	D	M	D	P	C	13.8	2100	2M	R	66	3600	GE	0.75	5	H	50.0	2	AsCu	.....	.....
DB	15.4	99.3	Re	M	V	M	S	P	C	13.0	2050	6M	S, Hy	80[4]	3600	GE	0.5	7	H	50.0	1	Ad	1,350	160
DB	13.3	115.0	Re	M	V	M	V	P	C	12.9	2600	2M	R, Hy	60/75	3600	WE	1.25	5	H	42.5	2	AAd	1,784	169
.....	.....	.....	Tu	M	D	M	D, Hy	P	C	10.4	1960	1M, 1T	Hy	60	3600	GE	0.5	5	H	50.0	2	AsCu	525	60
DB	14.8	149.4	Re	M	D	M	D	O	O	18.3	.....	3M	Re	66	3600	GE	1.25	5	H	50.0	2	AlBr	1,400	154
DB	23.7	122.5	Tu	M	D	M	Ma	P, O	C, O	13.0	2000	3M	Hy	25	3600	GE	415	...	H	.....	...	.....	.....	260
DB	15.8	181.6	Re	M	V	M	Hy	P	C	13.0	2100	2M	R	100	3600	WE	0.75	6	H	65.0	2	Adl	2,970	265
DB	15.8	181.6	Re	M	V	M	Hy	P	C	13.0	2100	2M	R	100	3600	WE	0.75	6	H	65.0	2	Adl	3,780	365
DB	22.6	175.5[10]	Re, Tu	M	V	M	D	P	C	12.5	.....	3M	R	80[5]	3600	WE	0.75	7	H	65.0	1	.....	3,600	320
DB	5.6	81.2	Re	M	V	M	Hy	P, G	C, G	9.2	1980	.....	.....	5	3600	WE	1.0	2	...	6.0	2	AsCu	1,335	90
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
DB	5.6	77.0	Re	M	V	M	Hy	P, G	C, G	9.2	1980	2M	R	40	3600	WE	0.75	5	H	35.0	2	AsCu	1,710	130
DB	.....	.....	Tu	M	D	M	D	G, O	G, O	1062[11]	.....	3M	R	75[4]	3600	WE	1.75	4	H	60.0	2	AsCu	1,550	130
ST	17.8	158.0	Tu	M	D	M	Ma	Cy	C	12.3	2100	2M	Hy	60	3600	AC	0.5	5	H	40.0	2	Ad	1,260	120
DB	35.7	297.0	Re	M	Hy	M	Hy	P, G	C, G	12.0	2500	3M	Hy	100	3600	GE	1.75	5	H	81.5	2	AAd	2,925	300
DB	25.7	83.9	Tu	M	V	M	V	P	C	11.6	2030	3M	R	60[4]	3600	.....	0.75	5	H	55.0	2	AsCu	.....	.....
DB	13.6	96.0	Re	M	D, V	M	D	P	C	12.0	2200	4M	R	40[4]	3600	WE	0.75	5	H	27.5	1	Ad	850	88
DB	12.6	121.0	Re	M	D, V	M	D, Hy	O, G	O, G	18.0	.....	3M	R	50	3600	GE	0.75	5	H	37.5	2	AlBr	1,575	135
DB	14.4	52.7	Re	M	V	Mp	V	P	C	11.3	2000	3M	.....	{40	3600	GE	0.5	5	H	37.0	2	Ad	1,200	105
														{15	3600	GE	275	0	H	.....	...	.....		
DB	.....	.....	Tu	M[12]	.....	M[12]	D	O	O	18.0	.....	3M	R	40[4]	3600	GE	1.0	5	H	32.5	1	CuNi	450	40
DB	.....	.....	Tu	M[12]	.....	M[12]	D	O	O	18.0	.....	3M	R	40[4]	3600	GE	1.0	5	H	32.5	1	CuNi	900	80
DB	.....	.....	Tu	M[12]	.....	M[12]	D	O	O	18.0	.....	3M	R	40[4]	3600	GE	1.0	5	H	32.5	1	CuNi	640	55
DB	.....	.....	Re	M[13]	V	M[12]	.....	O	O	18.0	.....	3M	R	10[11]	3600	WE	1.0	3	A	10.0	1	AlBr	890	53.5
DB	10.3	141.6	Re	M	Ma	M	Ma	P, G	C, G	10.4	1900	2M	.....	60	3600	GE	0.75	4	H	45.0	2	PAd	3,690	262
DB	14.5	103.4	Re	M	Ma	M	Ma	P, G	C, G	10.4	1990	2M, 1T	.....	60	3600	WE	0.75	5	H	50.0	2	PAd	600	60
.....	5.4	25.2	Tu	M	V	M	Ma	TG (742)	An	11.0	.....	2M	R	40	3600	GE	0.75	5	H	42.5	2	AAd	790	85
DB	.....	.....	Re	Mp	D, V	Mp	D	P	C	13.0	2500	2M	R	30[4]	3600	WE	0.75	5	H	27.5	2	Ad	996	87
DB	9.5	165.2	Re	M	D	M	D	P, O	C, O	.....	.....	6M	R	100[4]	1800[15]	CP	0.75	4	H	60.0	2	Adl	1,700	200
DB	8.5	136.8	Re	M	Hy	M	Hy	P, O	C, O	.....	.....	4M	Hy	60[4,8]	3600	EE	0.75	5	H	28.0	1	Adl	1,300	120
DB	26.0	85.4	Re	M	S, Hy	M	S, Hy	P	C	10.7	1900	2M	R	80	1800	GE	0.7	4	H	77.0	2	Ad	3,000	320
DB	26.0	85.4	Re	M	S, Hy	M	S, Hy	P	C	10.7	1900	2M	R	80	3600	WE	0.7	5	H	77.0	2	Ad	3,980	400
DB	5.8	62.4	Re	M	D, V	M	D	O, G	O, G	18.5	.....	6M	R	{60[5]	3600	GE	0.75	4	H	42.5	2	AlBr	2,800	264
														{60[5]	3600	WE	0.75	4	H	42.5	2	AlBr		
														{6	3600	WE	18.0	0	A	.....	...	.....		
DB	0	87.0	Re	M	D, Hy	M	D, Hy	P, O	C, O	14.0	.....	2M, 1T	.....	45	3600	GE	0.75	3	H	36.0	2	Ad	2,500	230
DB	0	118.4	Tu	M[13]	V	M[12]	V	P, G	L, G	9.3	2090	3M	R	40[4]	3600	GE	0.75	5	H	30.0	2	PAd	450	40
DB	0	118.4	Tu	M[13]	V	M[12]	V	P, G	L, G	9.3	2090	3M	R	40[4]	3600	WE	0.75	5	H	30.0	2	PAd	900	80
DB	0	118.4	Tu	M[12]	V	M[12]	V	P, G	L, G	9.3	2090	3M	R	40[4]	3600	GE	0.75	5	H	30.0	2	PAd	1,350	120
DB	0	92.1	Re	M	D, V	M	D, V	P, G	C, G	12.0	2700	2M	R	40[4]	3600	AC	1.0	5	H	30.0	1	Ad	1,225	120
DB	0	35.0	Tu	Mp	V	Mp	D	G, O	G, O	1045[11]	.....	2M	R	24	3600	WE	1.0	3	H	20.4	2	Ad	690	72
DB	18.1	36.5	Re	M	V	M	D	G, O	G, O	1040[11]	.....	2M	R	40[4]	3600	GE	1.33	5	H	32.5	2	Ad	425	44

Pl – Plate
R – Regulator
Re – Regenerative
RS – Riley Stoker Corp
S – Speed control
SP – Springfield Boiler Co
SS – Spreader stoker
ST – Slag tap
T – Turbine drive

TG – Traveling-grate stoker
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
Wi – Wickes Boiler Co
(306) – Sq ft stoker area

[1]–Revised, first listed 1949 survey
[2]–Reheat to 1000 F
[3]–Includes reheater
[4]–AIEE-ASME preferred standard
[5]–7,500 kw house generator
[6]–AIB in air-cooler section
[7]–Forced circulation
[8]–2 units installed
[9]–Reheat to 950 F
[10]–Two-section heater
[11]–Btu per cu ft
[12]–2 fans
[13]–Extraction at 315 psig
[14]–Also 1500 rpm
[15]–Pressurized furnace
[16]–Hp 3600, L-p 1800 rpm
[17]–Used equipment to meet critical conditions
[18]–Coke-oven gas

1950 Design Survey of Typical New

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers	First operation, new units	Nominal pressure, psig	Nominal steam temperature, F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Boiler, waterwall surface, 1000 sq ft	Superheater surface, 1000 sq ft	Furnace volume 1000 cu ft	Heat release, 1000 Btu per cu ft per hr
600 TO 799 PSIG													
Minnesota Power & Light Co	Duluth, Minn.	M L Hibbard	Ebasco Services Inc	5-51	850	900	1	350	EC	.....	8.8	21.5	.....
Florida Power & Light Co	Nr Palatka, Fla.	Palatka	Ebasco Services Inc	1951	850	900	1	350	CE	.....	.....	.....	.....
Worcester County Elec. Co	Worcester, Mass.	Webster St.	United Engrs & Const.	10-50	850	900	1	325	RS	33.1	11.2	20.0	19.5
El Paso Electric Co	Nr El Paso, N.M.	Rio Grande	Stone & Webster	2-51	850	900	1	335	BW	23.1	6.7	14.4	32.2
West Texas Utilities Co	Quanah, Texas	Lake Pauline	Sargent & Lundy	.....	850	900	1	250	BW	17.7	.....	.....	.....
Otter Tail Power Co	Ortonville, Minn.	Ortonville	J F Pritchard & Co	11-50	850	900	1	160	CE	20.5	5.7	12.3	19.6
Central Illinois Light Co	Peoria, Ill.	R S Wallace	Commonwealth Ass. Inc	2-52	810	900	1	600	RS	39.9	26.7	57.2	14.5
Consumers Power Co	Essexville, Mich.	J C Weadock	Commonwealth Ass. Inc	11-49	800	875	2	600	FW	22.2	15.6	36.6	19.0
	Comstock, Mich.	B E Morrow	Commonwealth Ass. Inc	8-49	800	875	1	600	FW	22.2	15.6	36.6	19.0
	Muskegon, Mich.	B C Cobb	Commonwealth Ass. Inc	8-50	850	900	1	600	CE	18.4	16.4	40.6	22.4
Arkansas Power & Light Co	Nr Hot Springs, Ark.	Lake Catherine	Ebasco Services Inc	3-50	850	900	2	450	CE	23.8	7.3	21.0	29.6
The Kansas Power & Light Co	Tecumseh, Kan.	Tecumseh	Black & Veatch	3-49	850	900	1	280	CE	.....	.....	.....	.....
				7-51	850	900	1	350	CE	.....	.....	.....	.....
	Hutchinson, Kan.	Hutchinson, No. 2	Black & Veatch	4-50	850	900	3	270	CE	.....	.....	.....	.....
				7-51	850	900	...	.....	.....	.....	.....	.....	.....
	Lawrence, Kan.	Lawrence	Black & Veatch	1-52	850	900	1	350	CE	19.2	.....	20.2	21.2
600 TO 799 PSIG													
Iowa Public Service Co	Sioux City, Iowa	Kirk		3-51	700	750	1	90	BW	.....	.....	4.1	29.6
Southern Colorado Power Co	Pueblo, Colo.	Pueblo	Pioneer Serv & Engrg.	6-49	650	900	1	185	BW	16.5	7.5	14.4	17.7
	Rocky Ford, Colo.	Rocky Ford	Stearns-Roger Mfg Co.	4-51	600	850	1	100	BW	10.3	5.0	5.4	23.8
Maine Public Service Co	Caribou, Maine	Caribou	Stone & Webster	11-50	600	825	1	90	CE	10.3	2.8	5.5	22.6
Western Colorado Power Co	Montrose, Colo.	Montrose		2-51	600	825	1	70	RS	10.6	.....	4.5	20.0
Mt Carmel Public Utility Co	Mt Carmel, Ill.			12-51	600	825	1	80	CE	9.8	.....	4.3	24.9
UNDER 600 PSIG													
Southwestern Publ Service Co	Sunray, Texas	Moore County	Stearns-Roger Mfg Co.	10-50	450	750	1	225	CE	20.7	.....	10.0	29.0
Saskatchewan Power Corp	Estevan, Sask.	Estevan	R E Hanright	2-51	415	750	2	100	CE	10.6	.....	4.7	37.0
Otter Tail Power Co	Crookston, Minn.	Crookston	J F Pritchard & Co	12-49	400	825	1	75	RS	11.4	1.5	4.8	22.7
Montana-Dakota Utilities Co	Mobridge, S.D.	Mobridge	Stearns-Roger Mfg Co.	11-50	400	750	2	50	BW	7.2	.....	2.7	28.2
Iowa Public Service	Carroll, Iowa	Carroll	Black & Veatch	10-51	400	750	2	60	RS	8.8	1.5	4.0	19.6
Central Kansas Power Co	Colby, Kansas	Colby		6-51	400	750	1	75	BW	8.9	.....	3.1	31.0
Northern States Power Co	Fargo, N.D.	Fargo	Pioneer Serv & Engrg.	9-49	400	750	1	75	VO	10.5	1.3	4.2	26.0
Iowa Southern Utilities Co	Centerville, Iowa	Centerville	Federal Engrg Co	2-49[17]	200	500	1	100	.....	.....	.....	.....	.....
	Ottumwa, Iowa	Ottumwa	Federal Engrg Co	10-49[17]	200	550	1	100	.....	.....	.....	.....	.....
Pacific Power & Light Co	Yakima, Wash.	Stm Htg Plant	J Donald Kroecker	10-50	150	Sat	2	18	BW	2.0	.....	.....	.....
MUNICIPAL AND COOPERATIVE PLANTS													
Board of Public Utilities	Kansas City, Kansas	Quindaro No. 2	Burns & McDonnell	5-51	875	910	1	300	BW	22.9	9.9	20.0	21.4
Central Power Electric Coop Inc	Voltaire, N.D.	Wm J Neal	Vern E Alden Co	9-51	850	900	2	230	CE	23.2	6.6	17.2	18.0
Dairyland Power Cooperative	Alma, Wis.	Alma	Vern E Alden Co	12-50	850	900	1	230	RS	23.3	7.3	1.5	21.7
	Cassville, Wis.	E J Stoneman	Vern E Alden Co	12-50	850	900	1	230	RS	23.3	7.3	1.5	21.7
City of Muscatine	Muscatine, Iowa		Stanley Engrg Co	11-49	650	825	1	160	BW	18.2	9.1	6.8	32.0
Corn Belt Power Cooperative	Humboldt, Iowa	Humboldt	Stanley Engrg Co	3-50	610	825	2	90	EM	10.3	2.8	6.3	21.0
Southwestern Federated Pwr Coop	Creston, Iowa	Creston	Stanley Engrg Co	2-51	600	825	2	100	.....	0.8	7.0	4.7	27.0
Brazos Riv Transmission Elec Coop	Belton, Texas	Bob Poage	Laramore & Douglass	3-50	600	825	1	115	.....	17.1	3.9	8.9	.....
City of Tallahassee	St Marks, Fla.	St Marks	Reynolds, Smith & Hills	10-51	600	825	3	85	BW	8.2	.....	3.8	.....
City of Lafayette	Lafayette, La.		Barnard & Burk	6-51	600	825	2	60	BW	6.5	1.7	3.1	25.8
Minnkota Power Cooperative	Grand Forks, N.D.	Franklin P Wood	Ellerbe & Co	12-49	600	815	1	135	RS	17.5	.....	7.8	25.0
							2	72	RS	9.5	.....	4.0	25.0
Dept of Municipal Service	Wyandotte, Mich.		Emery, Markest, Emery	5-51	600	800	1	140	BW	.....	.....	.....	.....
Water, Gas & Electric Dept	Danville, Va.	Brantly	Chas T Main, Inc	6-49	600	750	1	85	RS	11.0	0.5	5.3	20.2
Manitowoc Public Utilities	Manitowoc, Wis.			3-51	450	750	1	150	WI	18.8	.....	8.4	25.0
Greenville Utilities Commission	Greenville, N.C.	Greenville	W C Olsen	.....	450	750	3	80	CE	.....	.....	.....	.....
Borough of Chambersburg	Chambersburg, Pa.		A C Wood Assoc	12-50	450	750	2	60	EM	.....	.....	.....	.....
City Water & Light Dept	Ottawa, Kansas		Black & Veatch	.....	450	750	2	50	RS	7.2	.....	.....	.....
City of Jackson	Jackson, Minn.		Pfeifer & Shultz	2-50	450	750	1	45	WB	7.7	.....	2.9	.....
Borough of Etna	Etna, Pa.			1-50	450	750	1	18	UI	.....	.....	1.6	22.0
Department of Utilities	Fremont, Nebr.		Lutz & May	10-50	400	825	1	90	MI	.....	.....	3.0	50.0
Orrville Municipal Utilities	Orrville, Ohio	N Vine St.	H R Hadlow	9-49	400	750	1	50	WI	.....	.....	.....	.....
City of Colorado Springs	Colorado Springs, Colo		Lutz & May	12-49	400	750	1	150	.....	14.9	2.8	.....	25.2
Water & Light Department	Thomasville, Ga.			1951	400	750	1	68	BW	6.3	.....	.....	37.7
City of Cedar Falls	Cedar Falls, Iowa		Stanley Engrg Co	9-50	400	750	1	72	MI	8.3	1.6	3.0	35.0
Frankfort Light & Power Plant	Frankfort, Ind.		Emery, Markest, Emery	10-49	375	700	1	110	BW	13.5	.....	5.0	.....
City of Weyburn	Weyburn, Sask.			5-49	300	700	1	25	FW	3.7	.....	1.2	.....
City of Medicine Hat	Medicine Hat, Alberta			1-49	270	550	1	70	FW	8.6	0.5	3.4	23.8

A – Air cooled
AAd – Arsenical Admiralty
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Adl – Admiralty, inhibited
AlB – Aluminum-bronze
AlBr – Aluminum-brass
AnAd – Antimony-Admiralty
An – Anthracite
AsAd – Arsenical Admiralty

AsCu – Arsenical copper
BW – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion Engineering-Superheater, Inc
CP – C A Parsons
CuNi – Copper-nickel
Cy – Cyclone furnace
D – Damper
DB – Dry bottom

DL – DeLaval Steam Turbine Co
EC – Erie City Iron Works
EE – English Electric
El – Elliott Co
EW – Edge Moor Iron Works, Inc
FW – Foster Wheeler Corp
G – Natural gas
GE – General Electric Co
H – Hydrogen cooled
Hy – Hydraulic coupling

L – Lignite
M – Motor drive
Ma – Magnetic coupling
MI – Murray Iron Works Co
Mp – Two motors per fan
MT – One motor, one turbine per fan
Mu – Muntz metal
O – Oil
P – Pulverized coal fired
PAd – Phosphorized Admiralty

Steam Central-Station Installations

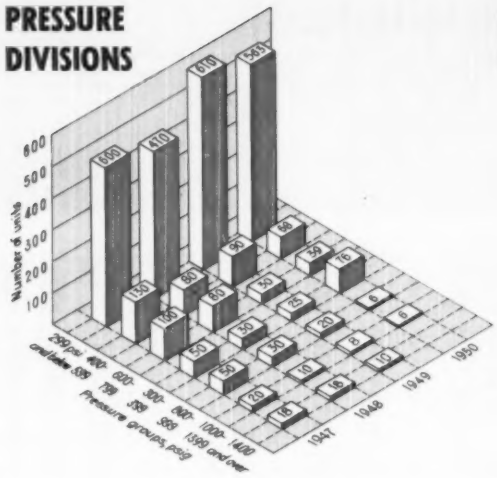
Furnace bottom	Economizer surface per boiler, 1000 sq ft	Air-heater surface per boiler, 1000 sq ft	Air-heater type	F-D FANS: Drive	F-D FANS: Air-flow control	I-D FANS: Drive	I-D FANS: Gas-flow control	Firing	FUEL: Type	FUEL: Heating value, 1000 Btu per lb	FUEL: Ash-softening temperature, °F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of bleed points	TURBINES: Generator cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity (net), 1000 lb	Total generator (net) rating, 1000 kw
DB	.....	51.8	.....	M	V	M	V	P	C	13.4	.....	2M,1T	.....	30[4]	3600	WE	0.5	4	H	20.0	1	Ad	1325	120
....	.....	.....	.....	....	.....	....	.....	O	O	18.3	.....	3M	.....	30[4]	3600	GE	1.25	4	H	30.0	2	AlBr	350	30
DB	0	72.5	Tu	M	D	M	D	P	C	13.8	2500	2M	R	30[4]	3600	WE	0.75	5	H	27.5	2	AlBr	1120	75
DB	0	61.2	Re	M	D,V	M	D,V	G,O	G,O	1115[11]	.....	2M	R	30[4]	3600	WE	0.75	4	H	19.0	2	Ad	1074	107
DB	.....	34.1	Tu	M[16]	V	.....	.....	G,O	G,O	1083[11]	.....	1M,1T	.....	20[4]	3600	GE	0.75	4	H	18.0	1	Mo	586	35
....	6.1	17.2	.....	...	.....	.....	.....	SS(445)	L	6.6	2000	2M,1T	.....	15	3600	GE	1.0	4	...	16.0	2	Ad	160	15
....	10.5	127.5	Tu	M	Hy	M	Hy	P	C	.....	1950	2M	R	60[4]	3600	WE	0.5	4	H	45.0	2	AsAd	2440	210
DB	34.6	60.1	Tu	M	V	M	Hy	P	C	12.5	2300	2M	.....	60[4,9]	3600	GE	0.75	4	H	42.5	2	PAd	3100	290
DB	34.6	60.1	Tu	M	V	M	Hy	P	C	12.5	2300	1M	.....	60[4]	3600	WE	0.75	4	H	42.5	2	PAd	1950	180
DB	20.4	111.0	Pl	M	Hy	M	Hy	P	C	12.5	2300	1M	.....	60[4]	3600	WE	0.75	5	H	42.5	2	AsAd	1800	180
DB	.....	66.6	Tu	M	V	M	D	G,O	G,O	1050[11]	.....	2M,1T	R	40[4]	3600	AC	0.75	4	H	27.5	1	Ad	900	88
DB	.....	.....	Re	M	Mo	M	Mo	P,G,O	C,G,O	11.5	1900	1M,1T	R	30[4]	3600	WE	0.75	4	H	.....	2	AsCu	950	82
DB	.....	.....	Re	M	Mo	M	Mo	P,G,O	C,G,O	11.5	1900	1M	R	.....	.....	...	.....	...	...	.....	...	.....	1300	82
DB	.....	.....	Re	M	V	M	Mo	G,O	G,O	1000[11]	.....	2M,1T	R	20[4] 20[4]	3600 3600	GE WE	0.75 0.75	4 4	H H	.....	2 2	AsCu AsCu	.....	20 40
....	.....	.....	.....	...	.....	...	.....	.....	.....	.....	.....	.....	.....	30	3600	GE	.....	5	H	.....	2	AsCu	810	70
....	.....	55.8	Re	M	Mo	M	Mo	P,G,O	C,G,O	12.1	2030	3M	R	30[4]	3600	WE	1.0	5	H	36.0	2	AsCu	470	40
....	3.8	6.9	Tu	M	V	M	S,D	SS(176)	C,O,G	11.0	2000	1M	R	7.5	3600	GE	1.0	3	A	8.0	2	PAd	375	20.7
DB	0	31.8	Re,Pl	M	D,Hy	M	D,Hy	P,G	C,G	10.5	2200	3M	R	15	3600	GE	0.75	3	H	16.0	2	Ad	415	30
DB	0	16.0	Tu	Mp	V	Mp	V	G,O	G,O	1000[11]	.....	2M	R	7.5	3600	WE	0.75	3	A	9.5	2	Ad	100	7.5
DB	2.1	6.6	Tu	M	D	M	D	SS(211)	C,O	10.5	1900	2M	R	7.5	3600	EI	0.75	3	A	7.0	2	Ad	90	7.5
DB	0	14.0	Tu	M	D,V	M	D,V	P	C	12.5	2300	2M	.....	5.0	3600	GE	0.75	3	A	5.0	2	Ad	70	5
....	2.0	4.8	Tu	M	D	M	D	TG(228)	C	11.0	2300	1M,1T	R	7.5	3600	AC	0.75	3	A	10.0	2	Ad	220	15
DB	0	27.8	Re	M	V	.....	D,V	G	G	1080[11]	.....	2M	R	15	3600	GE	.....	4	H	20.0	2	AsAd	330	26.2
....	0	4.8	.....	M	D	MT	Hy	TG(434)	L	7.0	2000	2M,1T	.....	15	3600	CP	0.4	1	A	13.0	2	Ad	240	22.5
....	0	6.3	.....	....	.....	.....	.....	.....	L	6.6	2000	2M	.....	5	3600	GE	1.0	3	A	7.0	2	Ad	150	10
....	0	4.9	Tu	M	V	M	V	SS(117)	L	7.7	2200	2M,1T	R	7.5	3600	GE	0.75	3	A	8.5	2	Ad	136	12
....	1.5	3.7	Tu	M	V	M	Hy	SS(155)	C	10.0	1980	1M,1T	R	5.0	3600	WE	0.75	3	A	6.5	2	PAd	120	5.7
DB	0	9.8	Tu	M	V	M	D	G,O	G,O	1000[11]	.....	1M,1T	.....	5.0	3600	WE	0.75	3	A	8.0	2	Ad	75	5.0
....	0	5.0	Tu	M	V	M	D	SS(230)	L	6.6	2043	1M	R	5.0	3600	GE	0.75	3	A	3.75	3	Ad	338	20
....	.....	.....	.....	T	V	T	D	SS	C	9.5	2000	1T	R	5.0	3600	WE	1.5	...	A	.....	...	.....	290	9.7
....	.....	.....	.....	T	V	T	D	SS	C	10.0	2000	1T	R	10	1800	GE	1.5	...	A	11.0	2	Ad	420	24.3
....	.....	.....	.....	M	D	M	D	O	O	18.0	.....	2M	R	.....	.....	...	.....	...	...	.....	...	.....	36	.....
ST	0	65.3	Re	M	V	M	Hy	P,G	C,G	.....	1950	2M	.....	30[4]	3600	WE	1.0	4	H	32.5	2	Ad	1100	100
DB	0	58.4	Tu	M	Hy	M	Hy	P	L	6.6	2200	3M	R	20[4]	3600	GE	0.75	4	H	13.0	2	AAd	460	40
DB	0	54.0	Tu	M	D,Hy	M	D,Hy	P	C	11.0	2200	2M	R	15[4]	3600	GE	1.0	4	H	12.0	2	Ad	550	45
DB	0	54.0	Tu	M	D,Hy	M	D,Hy	P	C	11.0	2200	2M	R	15[4]	3600	GE	1.0	4	H	12.0	2	Ad	260	15
....	11.5	0	.....	Mp	,DV	Mp	V	SS,TG	C,G	11.0	2070	M	R	12.5	3600	GE	1.0	3	A	14.0	1	Ad	440	27.3
....	2.9	6.6	Tu	Mp	D	Mp	V	SS,TG	C,G	11.0	2150	1M,1T	R	7.5[4]	3600	EI	1.0	3	A	10.0	2	Ad	180	15
....	2.5	6.3	Tu	Mp	D	Mp	D	SS,TG	C,G	10.1	2000	1M	R	7.5[4]	3600	GE	1.0	3	A	10.0	2	Ad	200	15
DB	0	14.6	Tu	M	V	M	Mo	G	G	1047[11]	.....	1M,1T	R	11.5[4]	3600	EI	1.25	4	A	14.0	2	Ad	115	11.5
....	.....	4.8	Tu	M	.....	Mp	.....	O	O	.....	.....	6M	.....	7.5	3600	WE	1.25	3	A	9.0	2	AlBr	170	22.5
DB	0	5.9	Tu	M	V	Mp	S,V	G,O	G	1100[11]	.....	2M,1T	R	4.0[4]	3600	GE	1.25	3	A	5.0	2	Ad	120	8
....	4.4	16.8	Tu	M	V	M	Hy	TG,SS	L,O	7.0	1900	2M	R	11.5[4]	3600	GE	0.75	3	A	13.0	2	Ad	.....	.....
....	2.1	8.6	Tu	M	V	M	Hy	TG,SS	L,O	7.0	1900	1M,1T	R	5.0[4]	3600	DL	0.75	2	A	6.8	2	Ad	279	21.5
....	.....	.....	.....	M,T	S	M,T	.....	SS	C	.....	.....	1M,1T	.....	11.5[4]	3600	GE	.....	4	...	.....	...	.....	320	25
DB	0	7.6	Tu	M	V	M	V	P	C	14.0	2600	1M,1T	S	7.5	3600	WE	1.0	2	A	.....	2	.....	85	7.5
DB	11.6	0	.....	MT	V	MT	D	TG(314)	C	13.5	2700	.....	.....	10	3600	AC	1.0	4	A	13	2	Ad	480	30
DB	0	.....	Re	M	V	MT	D	P	C	14.0	.....	1M,3T	R	15	3680	GE	.....	1	A	.....	2	.....	240	15
DB	.....	.....	Tu	M	D	T	D	P	C	.....	.....	1M,1T	R	5	3600	WE	0.5	...	A	.....	...	.....	140	11
DB	.....	0	.....	...	.....	Mp	S	G	G	.....	.....	2M,1T	R	4	3600	GE	0.5	2	A	.....	2	Ad	100	5.8
DB	0	4.3	Tu	T	D	M	D	G,O	G,O	1010[11]	.....	1M,1T	R	2.0	3600	EI	1.0	1	A	3.0	2	Mo	85	3.4
....	0	0	.....	MT	V,Mo	MT	V,Mo	TG(120)	C	12.5	2450	.....	.....	.....	.....	...	.....	...	...	.....	...	.....	.....	.....
....	.....	0	.....	Mp	S,D	Mp	S,D	UF(198)	C,G	12.5	2000	2M,1T	S	10	3600	GE	0.75	...	A	10.0	3	Ad	300	21
....	.....	.....	.....	MT	S,D	...	.....	SS	C	11.5	2000	M,T	.....	5	3600	AC	1.0	2	A	.....	2	Ad	114	10
DB	0	1.9	Tu	M	V	Mp	S,V	G	G	1000[11]	.....	1M,1T	R	10	3600	GE	0.75	4	A	13.0	2	PAd	410	25
DB	.....	7.3	Tu	M	D	M	Hy	P	C	13.0	2650	1M,1T	R	5	3600	WE	1.25	3	A	6.0	2	Ad	.....	15
....	5.5	0	.....	M	V	M	V	SS	C	11.0	2100	1M,1T	R	5	3600	GE	1.0	3	A	4.0	1	Ad	200	9.0
....	2.9	0	.....	MT	Mo,V	MT	Mo,V	SS(252)	C	11.2	2000	2M,1T	R	10	3600	EI	.....	...	A	.....	...	.....	282	12.8
....	.....	0	.....	M	.....	M	Mo	SS(84)	L	.....	.....	2M	.....	1.5	3600	CP	0.75	2	A	2.1	2	.....	55	2.8
DB	0	0	.....	M	D,V	M	.....	G	G	980[11]	.....	2T	R	5	3600	CP	0.75	3	A	4.8	2	.....	192	13.4

Pl – Plate
R – Regulator
Re – Regenerative
RS – Riley Stoker Corp
S – Speed control
SP – Springfield Boiler Co
SS – Spreader stoker
ST – Slag tap
T – Turbine drive

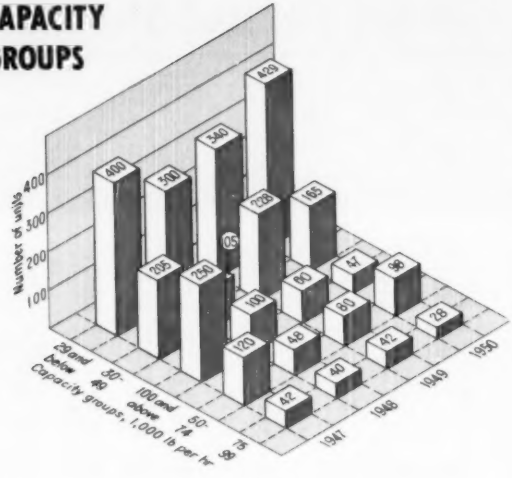
TG – Traveling-grate stoker
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
WI – Wickes Boiler Co
(306) – Sq ft stoker area

[1] – Revised, first listed 1949 survey
[3] – Reheat to 1000F
[5] – Includes reheater
[6] – AIEE-ASME preferred standard
[7] – 7,500 kw house generator
[8] – AIB in air-cooler section
[9] – Forced circulation
[10] – 2 units installed
[12] – Reheat to 950F

[13] – Two-section heater
[14] – Btu per cu ft
[15] – 2 fans
[16] – Extraction at 315 psig
[17] – Also 1500 rpm
[18] – Pressurized furnace
[19] – Hp 3600, L-p 1800 rpm
[20] – Used equipment to meet critical conditions
[21] – Coke-oven gas



Industry's need for heat and process steam is reflected in use of I-p boilers. Note: Pressure scale is not consecutive



Smaller boilers lead in number of units; larger ones add up to greater total output. Capacity scale is not consecutive

Industry Seeks Fuel Flexibility

Engineers of more than 400 industrial and institutional plants have cooperated with us to bring you the technical data making up the tables on the following pages. They have thus made it possible for us to present the most comprehensive picture of new steam-plant installations we have yet published. Study of these tables will give you a bird's-eye view of what your fellow engineers are doing in the way of modernization, expansion and new construction.

Besides the facts in the following pages of tables, we have partial information on other installations currently on order or under construction. This makes a total of about 750 plants. Above charts on pressures, capacities and firing methods are based on this larger body of data. So also are tables on facing page. For 1950, we are able to break down data on firing methods more completely than before. Bear this in mind when comparing 1950 figures with past years.

Electricity Generation. In past reviews of industrial-power trends, we have noted a tendency for growth of electrical load to outstrip that of process and heat loads. The reasons for this are familiar—rapid adoption of air conditioning for both process work and comfort, greater use of refrigeration, higher levels of illumination, heavier power use in working, fabricating and handling materials. To the extent that such increases in electrical demand cannot be economically met by power generation as a byproduct of steam production, industry's use of central-station energy has increased. Yet it is interesting to note that of the plants reported in the tabulations on following pages, over 90% with boilers operating at more than 300 psi generate at least part of their electric-energy requirements.

Pressures, Capacities. As the first two charts above indicate, greatest number of industrial boilers fall into the 299-psi-and-below pressure class, and are of less than 30,000 lb per hr. Almost three-quarters of the total number of boilers on which 1950 data are available operate at pressures below 300 psi. And somewhat more than one-half are of less than 30,000-lb-per-hr capacity. But total output of boilers above 30,000 lb per hr is greater than that of smaller units.

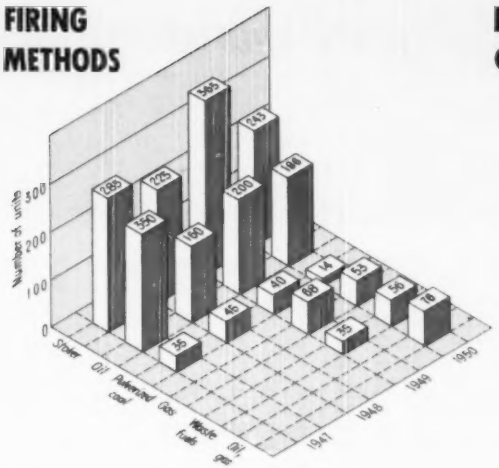
In the figures for this year, pressure range from 300 to 799 psi represents a substantial pecentage of those reported —about 25%. Less than 2% operate at 800 psi or above. To some extent, this concentration in lower and middle pressure ranges reveals the fact that many of industry's boilers are installed only to generate steam for process and heating. And where power generation is involved, pressure levels will be fixed, in the main, by need for a reasonably good balance between process and power demand.

Undoubtedly, also, designers of industrial plants tend to be more conservative in the matter of pressure (and temperature) because most such plants operate with relatively high percentages of makeup. This tends to make water treatment more complex and more expensive. Yet experience with high-pressure high-temperature industrial power plants indicates that economical and reliable operation is obtained. Thus, in industries where electrical load is high in relation to steam load, we can expect to see wider use of higher pressures and temperatures.

Fuels, Firing. This year's returns from the more than 400 plants reporting reflects industry's reaction to the rather erratic fuels situation of recent years. These returns, largely confirmed by what is known of the larger group of current orders, reveal recognition of the need for fuel flexibility.

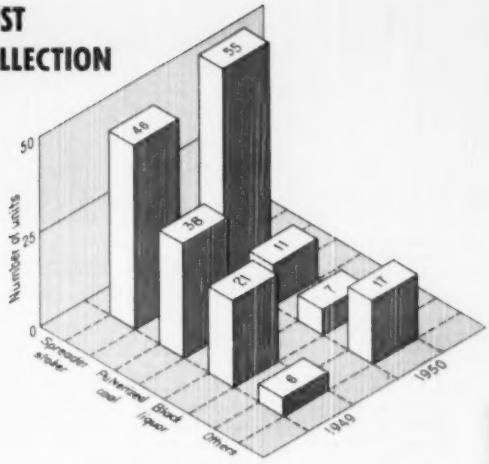
A number of straws point this way. Spreader stokers, suitable for a wide range of coals, enjoy wide popularity. A significantly large number of units designed for firing both oil and gas are reported. The number of pulverized-

FIRING METHODS



Breakdown by fuels and firing methods: Number of units with both oil and gas firing shows interest in fuel flexibility

DUST COLLECTION



Number of dust collectors plotted against method of firing again reveals most installations on spreader-stoker units

TABLE I—PRESSURE DIVISIONS

Pressure, psi	STOKER				OIL				PULVERIZED COAL				Gas	Gas, Oil	Coal, Oil, Gas	Waste Fuels	OTHERWISE			
	1947	1948	1949	1950	1947	1948	1949	1950	1947	1948	1949	1950	1950	1950	1950	1950	1947	1948	1949	1950
299 and below	247	187	201	186	260	138	129	138	8	6	5	2	31	62	—	15	143	115	88	125
300–399	7	1	6	9	14	6	2	37	1	4	2	1	9	10	—	—	20	13	5	12
400–599	21	34	18	17	24	7	9	14	10	17	12	4	1	4	2	10	73	12	21	16
600–799	6	4	7	7	27	8	4	2	24	22	7	1	8	5	2	8	34	35	11	12
800 and above	4	8	1	3	19	5	4	—	6	15	4	2	—	2	1	3	—	—	—	—

TABLE II—CAPACITY DIVISIONS

Capacity M lb per hr	STOKER				OIL				PULVERIZED COAL				Gas	Gas, Oil	Coal, Oil, Gas	Waste Fuels	OTHERWISE			
	1947	1948	1949	1950	1947	1948	1949	1950	1947	1948	1949	1950	1950	1950	1950	1950	1947	1948	1949	1950
29 and below	132	108	205	144	130	110	92	119	4	2	1	0	25	55	0	14	133	183	36	72
30–49	58	47	90	42	92	26	72	37	4	7	4	0	16	5	0	12	60	27	41	53
50–74	34	25	28	45	30	17	21	26	5	9	10	0	10	5	0	10	55	10	18	2
75–100	4	18	13	4	11	0	11	1	2	14	4	3	0	4	0	10	28	8	9	6
Above 100	24	21	13	7	91	13	12	3	31	38	21	10	2	7	4	10	14	26	15	4

fuel units, never large, is lower this year than in the past, and most of these are boilers of large output. While pulverized-coal firing, like spreader firing, is suitable for a wide range of coals, it is likely to represent a greater investment, particularly for smaller units.

Dust Collection. Beginning last year, our tabulations of industrial-plant design details have included data on dust-collector installations. These are summarized in the chart above, showing collectors by types of firing. Total number of collectors reported this year is less than last, probably because of a smaller number of pulverized-coal units and a considerably larger number of boilers firing oil, gas, or both. Again, most installations are on spreader-stoker units.

Outdoor Construction. Although this industrial-plant survey gathers no facts on outdoor and semi-outdoor installations, there is evidence that such construction is gradually gaining favor. In many industries (oil refining and chemical processing, for example) outdoor installation of processing equipment is common practice and this familiarity with the problems and their solutions, and with the economics of such construction, makes it easier to apply the practice to power-plant units.

1950 Design Survey of Typical Industrial and

Compiled by J C McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation, new units	Nominal pressure, psi	Nominal steam temperature, F	BOILERS: Number	Capacity, each, 1000 lb per hr	Manufacturer	Heating surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface, per boiler, 1000 sq ft
600 PSI AND ABOVE													
Carnegie-Illinois Steel Corp	Chicago, Ill	United Engrs & Constr Corp	1951	1025	900	1	650	RS	75.1	49.0	17.5	DB	12.0
Imperial Irrigation Distr	El Centro, Calif	Gibbs & Hill	1952	960	900	1	300	BW	28.4	11.1	34.3	DB	.....
Macon Kraft Co	Macon, Ga		1949	850	750	2	150	CE	.....	.....	19.8	DB	.....
						1	100	CE					
						2	150	CE					
Mack Molding Co	Arlington, Vt		1949	800	518	1	12	BW	2.0	.....	.....	.....	.....
Gulf Oil Corp	Toledo, Ohio		1948	725	605	2	70	BW	7.4	.....	.....	.....	.....
Pacific Mills, Ltd	Ocean Falls, B. C		1948	725	750	1	175	BWG	15.6	7.0	19.7	DB	0
Fraser Paper, Ltd	Madawaska, Me	Stone & Webster	5-50	700	750	1	150	CE	.....	9.3	19.0	.....	.....
American Boxboard Co	Filer City, Mich	Carroll, Bechtel & Langtry	5-50	675	750	1	125	BW	11.8	.....	.....	DB	.....
American Cyanamid Co	Pearl River, N. Y		1950	675	750	1	85	FW	14.1	5.3	22.7	.....	.....
Central Soya Co	Decatur, Indiana	Sargent & Lundy	1950	675	760	1	80	BW	7.9	3.4	27.3	.....	5.2
National Container Corp	Ontongon, Mich	Helmick, Edeskuty & Lutz	1949	675	700	1	47	CE	13.9	.....	.....	.....	1.7
Carnegie-Illinois Steel Corp	Gary, Indiana	United Engrs & Constr Corp	9-49	650	825	3	250	RS	79.6	18.0	19.9	DB	4.7
Continental Oil Co	Ponca City, Okla		1-50	650	750	1	90	Vo	9.8	4.8	27.9	.....	0
Fibreboard Products, Inc	East Antioch, Calif	Leland S. Rosener	1949	650	750	2	160	BW	15.2	.....	.....	DB	.....
						1	109	BW	23.2	.....	.....	.....	4.6
H J Heinz Co	Pittsburgh, Pa		1950	650	730	2	70	CE	7.8	3.0	.....	.....	2.9
Thilmany Pulp & Paper Co	Kaukauna, Wis	Pfeifer & Schultz	1949	650	700	1	90	BW	3.3	4.5	34.0	.....	2.2
Carnegie-Illinois Steel Corp	Rankin, Pa		4-50	625	750	1	300	RS	119.3	23.0	19.9	DB	0
Jefferson Chemical Co	Port Neches, Texas		1949	625	760	3	85	FW	12.1	4.8	23.7	DB	0
						1	52	CE	.....	.....	.....	.....	.....
Riegel Paper Co	Acme, N. C	J E Sirrene	1951	625	725	1	100	CE	.....	.....	.....	.....	.....
						1	100	CE	.....	.....	.....	.....	.....
Tennessee Eastman Corp	Kingsport, Tenn		1949	620	710	3	150	BW	18.8	8.1	26.4	.....	7.3
American Boxboard Co	Filer City, Mich	Carroll, Bechtel & Langtry	5-50	615	750	1	125	BW	11.8	.....	21.5	DB	.....
Medford Corp	Medford, Oregon		1950	600	680	1	100	RS	18.5	9.7	18.2	.....	0
West Virginia Pulp & Paper	Charleston, S. C		1950	600	700	1	325	FW	26.6	17.5	26.0	DB	22.8
			1949	600	700	1	103	BW	22.5	.....	.....	.....	5.2
West Virginia Pulp & Paper	Luke, Md		1950	600	700	1	103	BW	22.5	.....	.....	.....	5.2
			1950	600	700	1	103	BW	22.5	15.2	.....	ST	5.2
100 - 599 PSI													
Minneapolis Street Rwy	Minneapolis, Minn		1949	525	850	1	160	BW	17.7	9.1	26.2	.....	8.4
Dow Chemical Co	Freeport, Texas		1-51	500	750	1	250	RS	24.6	11.0	34.2	.....	0
Hudson Pulp & Paper Corp	Palatka, Fla	J E Sirrene	1951	500	750	1	60	BW	3.4	2.5	.....	DB	.....
						1	60	BW	3.4	2.5	.....	DB	.....
New York & Pennsylvania Co	Johnsonburg, Pa		1950	500	Sat	1	85	CE	.....	.....	.....	.....	.....
Pabst Brewing Co	Milwaukee, Wis	Stone & Webster	1-50	500	575	3	68	EM	12.7	3.2	26.9	DB	3.9
St. Joseph Lead Co	Josephtown, Pa		1950	500	700	3	8	BW	.....	.....	.....	.....	.....
Tulsa Water Works	Tulsa, Okla	G F Phillips & Assoc	6-50	500	750	1	34	UI	4.7	.....	28.0	.....	0
W T Carter & Brother, Lumber	Camden, Texas	H E Bovay, Jr	1950	475	580	2	35	Vo	5.4	.....	18.7	.....	.....
J I Case Co	Racine, Wis		1949	475	750	1	100	MI	7.9	.....	35.5	.....	3.7
Crossett Paper Mills	Crossett, Ark		.....	475	700	1	89	CE	22.1	.....	.....	ST	2.8
Florida State Hospital	Chattahoochee, Fla	Reynolds, Smith & Hills	3-50	475	575	1	60	BW	.....	.....	.....	.....	.....
International Paper Co	Corinth, N. Y		1950	475	700	1	80	CE	11.3	3.1	33.8	DB	4.9
Miller Brewing Co	Milwaukee, Wis	A G Behling	1950	475	700	2	40	Wi	7.0	2.7	22.0	DB	.....
Stanolind Oil & Gas Co	Andrews County, Texas		1949	475	712	3	40	BW	.....	.....	.....	.....	.....
Sutherland Paper Co	Kalamazoo, Mich		1950	475	650	1	100	Wi	11.5	5.3	24.6	DB	6.4
Lee Rubber & Tire Co	Conshohocken, Pa		1950	460	700	.....	.....	.....	.....	.....	.....	.....	.....
Harvard Brewing Co	Lowell, Mass	C T Main, Inc	1949	450	353	2	21	BW	2.8	.....	.....	.....	.....
Hudson Pulp & Paper Corp	Palatka, Fla	J E Sirrene	1951	450	725	1	113	BW	13.7	.....	.....	ST	4.9
International Paper Co	Georgetown, S. C		1949	450	675	1	200	BW	17.6	13.0	20.0	.....	2.9
Magnolia Petroleum Co	Beaumont, Texas		9-50	450	675	1	175	CE	15.9	8.4	27.8	DB	.....
Magnolia Petroleum Co	Rush Springs, Okla		1950	450	690	2	25	Vo	.....	.....	.....	.....	.....
John Morrell Co	Sioux Falls, S. D	Helmick, Edeskuty & Lutz	1950	450	700	1	100	BW	10.4	9.2	.....	.....	.....
National Container Corp	Jacksonville, Fla		4-50	450	700	1	75	CE	20.0	.....	.....	.....	2.3
Niagara Alkali Co	Niagara Falls, N. Y		1950	450	421	1	65	BW	6.3	.....	.....	.....	.....
Quaker State Oil Refining	Emlenton, Pa		1950	450	525	1	60	BW	.....	2.5	.....	DB	.....
Riegel Textile Corp	Ware Shoals, S. C		1950	450	535	1	120	RS	16.8	7.8	.....	DB	0
Spreckles Sugar Co	Spreckles, Calif		7-50	450	600	1	175	CE	15.3	7.3	30.0	.....	.....
Celina Stearic Acid Co	Celina, Ohio		1948	425	Sat	1	12	BW	.....	.....	.....	.....	.....
Fletcher Paper Co	Alpena, Mich	Cummins & Barnard	.....	425	700	1	45	Wi	6.2	2.4	26.7	DB	3.6
Congoleum-Nairn Inc	Kearny, N. J		1949	420	710	1	60	BW	7.0	2.7	30.0	DB	.....
American Coating Mills	Middletown, Ohio	B M Baxter	1949	400	600	1	55	BW	6.1	.....	.....	.....	3.6
Dept of Public Works	Chicago, Ill		1952	400	648	4	45	EM	7.5	2.3	.....	.....	0
Liberty Powder Co	Mt. Braddock, Pa		1949	400	371	2	17	BW	2.8	.....	.....	DB	0
Lone Star Steel Co	East Texas, Texas		.....	400	750	1	100	RS	.....	.....	.....	DB	.....
				400	750	3	100	BW	50.0	25.0	.....	DB	.....

A – Air-cooled
AAd – Arsenical Admiralty
AC – Allis-Chalmers Mfg Co
AsCu – Arsenical copper
Ad – Admiralty
AI – Ames Iron Works
An – Anthracite
Bl – Bigelow Co
BL – Black liquor
Br – Brass
BT – Babcock & Wilcox Co
BWG – Babcock & Wilcox, Goldie – McCullough
C – Coal, bituminous
CB – Cleaver-Brooks Co
CE – Combustion-Engineering-Superheater, Inc
CuNi – Copper-nickel
CV – Canadian Vickers, Ltd
D – Damper
DB – Dry bottom
DL – DeLaval Steam Turbine Co
Du – Duplex pump
E – Electrostatic
EC – Erie City Iron Wks
El – Elliott Co
EM – Edge Moor Iron Wks, Inc
FT – Foster Wheeler Corp
G – Gas
GE – General Electric Co
H – Hydrogen cooled
HF – Hogged Fuel
Hy – Hydraulic coupling
Ke – E Keeler Co
M – Motor drive
Mu – Magnetic coupling
Ms – Mechanical
MT – One motor, one turbine per fan
Mu – Muntz metal
O – Oil

Institutional Power Plants: 200 Psi and Above

Air-heater surface, per boiler, 1000 sq ft	Air-heater type	Dust collectors	F-D FANS: Drive	F-D FANS: Air-volume control	I-D FANS: Drive	I-D FANS: Gas-volume control	Firing	FUEL: Type	FUEL: Heating value, 1000 Btu per lb	FUEL: Ash-fusion temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of bleed pts	Generator cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity, Inst new units, 1000 lb	Total generator capacity Inst new units, 1000 kw
100.0	Tu	.....	M	D	M	S	O,G [1]	G	90	.....	2 T	S	60	3600	GE	1.0	5	H	55.0	2	Ad	650	60
40.1	Re	.....	M	V	M	D	O,G [2]	O	18.2	.....	2 M	R	30	3600	AC	1.0	5	H	27.5	2	.....	560	50
.....	Tu	Me	M	D	N	D	P	C	13.0	2200	2M, 1T	R	5.0	3600	GE	1.0	1	A	5.0	2	Ad	700	17.5
.....	.....	.....	.....	.....	.....	.....	ww	.....	6.8	.....			5.0	3600	GE	1.0	1	A					
.....	.....	E	M	S,Hy	M	S,Hy	BL	.....	.....	.....			7.5	3600	GE	40.0	1	A					
.....	.....	.....	M	V	M	S	O	O	17.5	.....	2 Du	R	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
4.1	Tu	O	M,T	V	M,T	V	O,G	O	.....	.....	2 T	S,R	.....	.....	.....	.....	...	...	.....	...	.....	456	0
21.2	Tu	O	T	S	T	S	O [2]	O	18.4	2060	1M, 1T	R	5.0	3600	Oe	140	1	A	.....	...	.....	400	14
.....	Tu	Me	M	D	M	D	P	C	10.5	.....	1M, 2T	R	.....	.....	.....	.....	...	...	.....	...	.....	355	12
43.2	Pl	.....	M	D	M	V	P,O	C	11.1	2000	2 T	S	5.0	3600	GE	50	2	A	4.5	2	Ad	.....	.....
6.9	.....	.....	.....	.....	.....	.....	SS (214)	O,G,An	.....	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
O	.....	Me	M	D	M	D	SS (145)	C	10.6	1900	1M, 1T	R	2.0	3600	GE	35	1	A	2.0	2	P Ad	150	4.0
.....	Tu	O	M	D	M	Hy	O,BL	BL	6.5	.....	2 T	S,R	2.0	3600	GE	0.75	1	A	.....	...	.....	100	3.5
38.5	Tu	O	T	S	T	S,D	O,G [1]	G	90	.....	1M,3T	S,R	1.0	3600	WE	175	...	A	.....	...	.....	2000	165
9.9	Tu	O	T	S	T	S	O,G	G	1.3	.....	1M,2T	S,R	8.0	3600	WE	190	...	A	4.2	2	A Ad	450	10
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.0	3600	EI	1.0	...	A	.....	...	.....	.....	.....
21.9	Tu	.....	.....	.....	.....	.....	O,G	O	18.0	.....	.....	.....	1.0	3600	AC	1.0	...	A	.....	...	.....	.....	.....
11.2	Tu	E	T	S	T	S	BL	BL	6.5	.....	.....	.....	10.0	3600	GE	1.0	...	A	.....	...	.....	429	15
.....	Tu	Me	M	D	M	D	SS (189)	C	12.0	2250	1M, 2T	R	5.0	3600	GE	50	...	A	.....	...	.....	.....	.....
7.6	.....	Me	M	Me	M	Me	SS (212)	C	12.5	.....	1 T	R	3.0	3600	WE	125	1	A	O	O	.....	173	3.0
75.0	Tu	O	T	S,V	T	S,D	P,G [1]	G	90	.....	3 T	S,R	.....	.....	.....	.....	...	...	.....	...	.....	1650	62
6.4	.....	.....	.....	.....	.....	.....	.....	G	G	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
4.7	.....	.....	.....	.....	.....	.....	SS	ww	4.6	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
13.2	.....	.....	.....	.....	.....	.....	O	O	18.5	.....	.....	.....	7.5	3600	GE	1.0	2	...	.....	...	.....	252	7.5
.....	.....	.....	.....	.....	.....	.....	BL	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
.....	.....	Me	T	.....	T	.....	SS (282)	C	.....	.....	1 T	S,R	6.0	1800	GE	1.0	1	A	8.6	2	.....	1842	43.5
21.6	Tu	.....	M	D	M	D	P,O	C	11.1	2000	2 T	S,R	5.0	3600	GE	0.75	2	A	4.5	2	Ad	340	8.0
13.2	Tu	Me	M	V	T	S	[3]	ww	8.0	.....	1M, 1T	S	4.5	3600	.....	150	...	A	.....	...	.....	200	4.5
.....	.....	Me	M	V	T	S,D	SS (516)	C,O	12.5	2200	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
11.1	Tu	E	M	D	T	S	BL	BL	4.0	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	1400	.....
11.1	Tu	E	M	D	T	S	BL	BL	4.0	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
11.1	Tu	E	M	D	T	S	BL	BL	4.0	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	925	.....
.....	.....	Me	M	Me	M	Me	SS (347)	C,G	12.0	2100	1 T	S,R	.....	.....	.....	.....	...	...	.....	...	.....	770	85
21.0	Tu	O	T	D	T	D	G	G	1.0	.....	1 M	.....	.....	.....	.....	.....	...	...	.....	...	.....	2000	97
6.8	Tu	.....	M	D	M	.....	O	O	17.7	.....	1M,2T, 1Du	R	7.5	3600	GE	1.25	2	A	5.0	2	Ad	500	15
6.8	Tu	.....	M	D	M	.....	ww	ww	.....	.....													
.....	.....	E	M	.....	M	D	BL	BL	5.0	.....	1M, 1T	.....	.....	.....	.....	.....	...	...	.....	...	.....	700	11
O	.....	Me	M	V	M	D	SS (154)	C,O	12.0	2200	1M, 2T	.....	1.5	3600	WE	10	1	A	.....	...	.....	204	3.0
.....	.....	E	.....	.....	T	S	WH	G [11]	.....	.....	2 M	S	0.3	3600	GE	25	1	A	1.25	2	Ad	38	1.3
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.0	5000	GE	25	1	A	.....	...	.....	.....	.....
.....	Tu	.....	.....	D	.....	.....	O,G	G	1.0	.....	2T	Hy	.....	3600	DL	0.75	2	...	.....	...	.....	68	.....
.....	.....	.....	.....	.....	M	.....	ww	ww	4.5	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	.....	.....
6.5	Tu	Me	M	V	M	Hy	SS (183)	C	11.0	2000	1M, 1T	S	5.4	3600	GE	.....	4	A	8.4	2	Ad	260	10
7.0 [4]	Tu	E	M	Hy	M	Hy	BL	BL,O,G	3.0	.....	2M, 1T	S,R	6.0	3600	WE	0.5	1	A	7.0	2	Ad	475	14.5
.....	Tu	O	M	D	M	D	P,O	C	14.4	2400	2M, 3T	S	1.0	3600	Wo	100	1		.....	...	.....	160	1.75
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.75	3600	GE	100	1		.....	...	.....	.....	.....
.....	.....	Me	MT	V	MT	D,Hy	TG (330)	An	12.1	2900	1M, 1T	.....	.....	.....	.....	.....	...	...	.....	...	.....	380	15
3.1	Tu	Me	M	V	T	S,D	SS (117)	C,O	12.1	2000	1M, 1T	S,R	2.5	3600	WE	15	1	A	.....	...	.....	125	3.0
.....	.....	.....	.....	.....	T	D	G	G	1.1	.....	1M, 1T	R	.....	.....	.....	.....	...	...	.....	...	.....	120	1.5
O	.....	Me	T	S	T	S	SS (212)	C	12.5	2400	1M, 1T	S	.....	.....	.....	.....	...	...	.....	...	.....	325	10.8
.....	.....	.....	T	V	M	D	O	O	.....	.....	1M, 1T	S,R	2.0	3600	EI	130	...	A	.....	...	.....	80	2.0
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	42	.....
10.8	Tu [5]	.....	M	S	T	.....	BL	BL	6.8	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	500	35
25.5	Tu	Me	T	D	T	S	SS (398)	ww,O	18.4	.....	2T	R	.....	.....	.....	.....	...	...	.....	...	.....	1500	30
14.2	Tu	.....	T	D	T	S	G	G	.....	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	1655	32.5
.....	.....	.....	D	M	D	O,G	G	1.1	.....	2T	R	1.2	4800	GE	.....	...	...	...	.....	...	.....	50	1.2
17.9	Tu	Me	MT	.....	MT	.....	P,O,G	C	.....	.....	1M, 2T	S	.....	.....	.....	.....	...	...	.....	...	.....	300	.....
.....	.....	.....	M	D	M	Hy	BL	BL	.....	.....	1M	.....	.....	.....	.....	.....	...	...	.....	...	.....	300	10
6.0	Re	Me	T	D	T	S	P	C	.....	.....	.....	.....	.....	.....	.....	.....	...	...	.....	...	.....	200	.....
.....	.....	.....	MT	V	MT	D	TG (149)	C	13.3	2110	2Du	S	.....	.....	.....	.....	...	...	.....	...	.....	190	.....
10.4	Tu	Me	M	D	M	D	P	C	14.0	2600	3M, 1Du	S,R	7.0	3600	GE	40	...	A	.....	...	.....	290	7.0
21.5	Re	O	MT	V	.....	D	O,G	O	18.5	.....	2M, 1T	.....	3.0	3600	WE	60	...	A	.....	...	.....	680	5.2
.....	.....	Me	M	D,V	.....	D	UF (50)	C	14.0	2650	4Du	R	0.2	.....	SE	2	...	A	.....	...	.....	.....	.....
O	.....	.....	M	D	M	D	SS (111)	C	11.6	.....	1M, 1T	.....	2.5	.....	EI	2.0	1	A	2.5	...	.....	.....	.....
6.6	Tu	Me	T	S	M	D	P,O	C	13.5	2600	1M	R	.....	.....	.....	.....	...	...	.....	...	.....	150	2.8
.....	.....	.....	M	D	T	S	TG (174)	C	.....	.....	1M, 1T	R	1.5	3600	WE	20	1	A	.....	...	.....	55	1.5
.....	.....	.....	T	D	.....	.....	UF (130)	C	13.0	2000	2M, 1T	S,R	.....	.....	.....	.....	...	...	.....	...	.....	100	.....
O	.....	.....	M	D	.....	D	SS (90)	C	14.0	.....	2 Du	R	.....	.....	.....	.....	...	...	.....	...	.....	34	12
.....	Tu	O	M	D	M	D	G [6]	G	90	.....	1M, 2T	R	10.0	1800	WE	1.0	0	A	45.0	2	Mu	400	17.5
.....	Tu	O	M	D	M	D	G [6]	G	90	.....			7.5	1800	GE	1.0	0	A					

Ov – Maschinen Fabrik Oerlikon
P – Pulverized-fuel firing
Pl – Plate
R – Regulator
RS – Riley Stoker Corp
S – Speed control
SE – Skinner Engine Co
SS – Spreader stoker
ST – Slag Tap

T – Turbine drive
Tr – Terry Steam Turbine Co
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
Vo – Henry Vogt Machine Co
W – Wood
W/H – Waste heat

WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
Wi – Wickes Boiler Co
Wo – Worthington Pump & Mach'y Corp, Moore Steam Turbine Division
WW – Wood waste

[1] – Blast-furnace gas
[2] – Future coal
[3] – Flat grate
[4] – Superheated
[5] – Gas-air heater
[6] – Blast-furnace, natural and coke-oven gasses
[7] – Bagasse
[8] – Pitch
[9] – Steam engines
[10] – Coke breeze
[11] – From zinc-concentrator roasting
(150) – Stoker grate area, sq ft

1950 Design Survey of Typical Industrial and

Compiled by J C McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation, year ends	Nominal pressure, psi	Nominal steam temperature, F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Heating surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Evaporation, surface, per boiler, 1000 sq ft
Sonoco Products Co	Hartsville, S. C.		.....	400	.....	....	.....	.....	.....	.....	.....	.....	.....
Canadian National Rwy	Montreal, Que		1949	380	493	1	15	FW	2.4	0.9	27.6	DB	.....
						1	90	FW	10.6	5.8	19.0	DB	.....
Carthage Fabrics Corp	Carthage, N. C		1950	375	410	1	3.6	CE	0.25	.....	.....	.....	.....
Pure Oil Co	Worland, Wyo		11-49	375	Sat	3	24	EC	3.5	1.0	32.5	DB	.....
Southwest Gas Producing Co	Dubach, La		1949	360	536	3	60	Vo	.....	.....	.....	.....	.....
Marinette Paper Co	Marinette, Wis		1950	350	500	1	50	BW	7.9	2.6	.....	.....	.....
Sarco Co	Bethlehem, Pa		1949	350	Sat	1	3.5	IB	0.4	0.1	38.0	DB	.....
Gypsum Lime & Alabastine Ltd	Winnipeg, Man	W M Bird	2-50	325	400	1	30	FW	4.6	1.6	26.2	.....	.....
American Seating Co	Grand Rapids, Mich	Hamilton, Weefer & Ward	1950	300	600	1	60	Wi	8.1	3.0	25.4	.....	3.2
Connecticut State Hospital	Middletown, Conn	Fletcher Thompson	5-51	300	455	4	40	BI	6.1	1.8	29.0	.....	.....
Cooperative Refinery Assn	Coffeyville, Kan		1950	300	464	1	50	EC	6.9	2.4	28.0	DB	.....
Great Falls Bleachery & Dye Wks	Somersworth, N. H.		4-50	300	.....	3	25	Wi	2.5	0.6	55.7	.....	.....
Mansfield State Training	Mansfield, Conn	Hurley & Capocefalo	11-50	300	456	3	30	Bi	4.3	1.4	28.0	.....	.....
Shell Oil Co	Elk City, Okla		1950	300	406	3	18.5	Vo	3.2	1.1	22.5	.....	.....
J P Stevens & Co	Cheraw, S. C.	J E Sirrene	1950	300	Sat	1	80	CE	9.4	.....	.....	.....	.....
Texas Gulf Sulphur Co	Worland, Wyo		1950	300	403	3	50	BW	6.0	.....	.....	.....	.....
						2	40	FW	3.8	.....	.....	.....	3.8
Torrance State Hospital	Torrance, Pa	H F Lenz	1950	300	366	1	45	BW	6.9	1.9	24.6	.....	0
United States Rubber Co	Los Angeles, Calif		8-50	300	Sat	1	70	BW	7.4	3.2	28.0	.....	.....
Univ of Oklahoma	Oklahoma City, Okla	Collins	1949	300	.....	2	10	MI	.....	.....	.....	.....	.....
Walker Bros	Conshohocken, Pa		1950	300	Sat	1	14	FW	1.7	.....	.....	.....	.....
250 TO 299 PSI													
Bethlehem Steel Co	Steelton, Pa		4-50	275	500	1	150	EC	21.1	13.5	14.8	DB	.....
California Co	Hico, La		1949	275	406	2	33	BW	.....	.....	.....	.....	.....
Hawthornden State Hospital	Macedonia, Ohio	Beiswenger & Hach	5-50	275	401	2	30	BW	.....	.....	.....	.....	.....
Indiana Farm Bureau Refinery	Mt Vernon, Ind		1950	275	406	1	22	Vo	3.2	.....	.....	.....	0.4
Liquid Carbonic Co	Cincinnati, Ohio		6-50	275	475	1	17	EC	3.1	1.0	32.5	DB	.....
Studebaker Corp	South Bend, Ind		1948	275	520	1	210	FW	22.3	9.7	29.1	.....	4.6
Texas State College for Women	Denton, Texas		1-49	275	509	2	32	Vo	5.6	.....	.....	.....	.....
Univ of Connecticut	Storrs, Conn	Hubbard, Lawless & Blakely	1950	275	Sat	2	35	Bi	5.0	1.9	24.0	.....	.....
Liquid Carbonic Co	Indianapolis, Ind		1950	270	480	1	15	CE	.....	.....	.....	.....	.....
Hughes Tool Co	Houston, Texas	Strauss, Frank Co	1950	255	474	2	21	BW	2.9	.....	.....	.....	.....
American Can Co	Milwaukee, Wis		6-50	250	Sat	2	50	EC	6.9	2.3	30.0	DB	.....
American Hide & Felt Co	Newark, N. J.	Geo Landon	1950	250	Sat	1	45	CE	6.2	1.8	30.7	DB	0
Armco Steel Co	Ashland, Ky		1950	250	488	3	70	BW	10.0	.....	25.0	.....	.....
Atlanta Water Wks	Atlanta, Ga		1949	250	538	1	44	BW	.....	.....	.....	.....	.....
Aurora Gasoline	Detroit, Mich		10-50	250	Sat	1	35	Bi	5.0	1.8	26.0	.....	.....
P Ballantine & Sons	Newark, N. J.		1949	250	366	1	60	BW	7.8	.....	.....	.....	.....
Barton Salt Co	Hutchinson, Kan		1951	250	500	1	39	BW	6.2	.....	.....	.....	.....
Beaver Wood Fibre Co, Ltd	Tharold, Ont		1-51	250	Sat	2	65	FW	.....	.....	.....	.....	.....
Burkhardt Brewery	Akron, Ohio	R W Berger	1949	250	.....	2	27	Vo	4.4	1.5	.....	DB	0
Certain-Teed Products Corp	York, Pa		1948	250	Sat	1	50	EC	.....	.....	.....	.....	.....
Consumers Heating Co	Klamath Falls, Ore		1-50	250	Sat	1	25	RS	3.6	1.9	19.7	DB	0.6
Cranston Print Wks	Fletcher, N. C.	J E Sirrene	1-50	250	500	1	50	BW	6.8	2.3	.....	.....	.....
Du Quoin Packing Co	Du Quoin, Ill	Farris & Honig	10-49	250	500	1	17	EC	3.0	0.7	35.0	DB	.....
Farmers Union Central Exch	Laurel, Mont		1950	250	Sat	1	75	Vo	10.1	4.1	21.8	.....	.....
Field Packing Co	Owensboro, Ky	A M Kinney	1949	250	416	1	27	CE	.....	.....	.....	.....	.....
Ford Motor Co	Hamburg, N. Y.	Fairbrother & Miehls	1950	250	Sat	3	40	CE	6.1	1.7	30.9	DB	0
Ganic Mfg Co	Ganic, N. H.	Harrison G White	1948	250	500	1	30	BW	4.4	.....	.....	.....	.....
Great Northern RR	Grand Forks, N. D.		5-50	250	381	1	29	WB	4.0	1.1	35	.....	.....
Hackensack Water Co	Oradell, N. J.		1951	250	507	2	30	CE	5.8	1.7	24.0	.....	3.9
Hanes Dye & Finishing Co	Winston-Salem, N. C.	W O Sprinkle	7-48	250	Sat	1	40	BW	7.1	.....	.....	.....	.....
Johns Manville Prod Corp	Richmond, Ind		1950	250	Sat	1	18	CE	3.2	0.7	.....	DB	.....
Juice Industries Div	Dunedin, Fla	B C Skinner	1950	250	Sat	1	60	CE	.....	.....	.....	.....	.....
Kalamazoo Vegetable Parchment	Espanola, Ont		2-50	250	450	1	100	CE	11.1	.....	.....	.....	.....
Kansas State College	Manhattan, Kan		1950	250	500	2	50	CE	6.8	1.7	40.5	DB	0
Kerr Bleaching & Finishing Wks	Concord, N. C.		1949	250	397	1	60	BW	7.9	2.4	30.0	.....	0
Kingan & Co	Richmond, Va	Allen J Saville, Inc	1950	250	324	1	33	BW	4.8	1.1	39.7	.....	.....
Charles Lachman Co	Phoenixville, Pa	C T Main	1950	250	Sat	3	22	CE	3.9	.....	.....	.....	.....
Lime-Hamilton Corp	Lima, Ohio		1950	250	Sat	2	75	CE	8.9	3.7	25.7	.....	0
Long Lac Pulp & Paper Co	Terrace Bay, Ont	Stadler, Hurter & Co	1948	250	Sat	3	85	FW	12.4	5.6	18.1	DB	.....
				250	Sat	1	130	CE	28.2	.....	.....	ST	.....
Lukens Steel Co	Coatesville, Pa		1950	250	500	2	23	FW	.....	.....	.....	.....	.....
Lula Factory Inc	Belle Rose, La		10-50	250	490	1	43	CE	5.9	1.5	.....	.....	.....
Lynchburg State Colony	Colony, Va		1950	250	Sat	1	21	CE	.....	.....	.....	.....	.....
Monsan State Hospital	Palmer, Mass	E C Brown Co	5-50	250	Sat	1	36	EC	4.3	0.9	53.0	DB	.....
National Vulcanized Fibre Co	Newark, Del		1949	250	Sat	1	27	CE	4.0	1.0	35.0	.....	.....
National Waterproof Papers	Camden, N. Y.		1950	250	Sat	1	21.6	CE	3.2	.....	.....	.....	.....
Neville Co	Pittsburgh, Pa		1949	250	400	1	16	CB	.....	.....	.....	.....	.....
N. Y. Butchers Dressed Meat	New York, N. Y.		7-50	250	Sat	2	50	CE	6.8	.....	31.8	.....	0
N. Y. Central System	Elkhart, Ind		1948	250	Sat	1	17.8	CE	3.1	.....	.....	.....	.....
						1	24.7	BW	4.0	.....	.....	.....	.....

A – Air cooled
AAd – Arrangiel Admiralty
AC – Allis-Chalmers Mfg Co
AsCu – Arsenical copper
Ad – Admiralty
Al – Assa Iron Works
An – Anthracite
Bi – Bigelow Co
BL – Black liquor
Br – Brass
BW – Babcock & Wilcox Co
BWG – Babcock & Wilcox, Goldie McCullough
C – Coal, bituminous
CB – Cleaver-Brooks Co
CE – Combustion-Engineering-Superheater, Inc
CuNi – Copper-nickel
CV – Canadian Vickers, Ltd
D – Damper
DB – Dry bottom
DL – DeLaval Steam Turbine Co
Du – Duplex pump
E – Electrostatic
EC – Erie City Iron Wks
El – Elliott Co
EM – Edge Moor Iron Wks, Inc
FW – Foster Wheeler Corp
G – Gas
GE – General Electric Co
H – Hydrogen cooled
HF – Hogged Fuel
Hy – Hydraulic coupling
Ke – E Keeler Co
M – Motor drive
Ma – Magnetic coupling
Mc – Mechanical
MT – One motor, one turbine per fan
Mz – Muntz metal
O – Oil

Institutional Power Plants: 200 Psi and Above

Air-heater surface, per boiler, 1000 sq ft	Air-heater type	Dust collectors	F-D FANS: Drive	F-D FANS: Air-volume control	I-D FANS: Drive	I-D FANS: Gas-volume control	Firing	FUEL: Type	FUEL: Heating value, 1000 Btu per lb	FUEL: Ash-fusion temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure psia	TURBINES: No. of bleed pts	Generator cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity 1000 lb	Total generator capacity last year units, 1000 kw
													10.0	3600	GE	35	1	A				285	14
								O														105	
2.7	Tu	Me	M	D	M	D	O	C	13.3	1970	1M, 1T	R											
9.5	Tu	Me	M	D	M	D	P, O	C	19.0														
			M	D, Hy			O	O, G															
			T	T, S	T	T, S	O, G	G	1.0		1M, 1T	S, R	0.7	3600	GE			A				180	1.4
					T	D	G	C	13.0	2800	2M, 1T	S										115	
			Me	M				O	18.5														
					M	D	SS(153)	Li	7.1	2200	2M	R										30	
			D		M	D	O	C	13.6	2600	1T	S, R										145	3.0
2.5	Tu		M	V	M	D	SS(105)	O															
			Me	M	V	M	S, O	SS(125)															
							O	O															
			T	S	T	D	O, G	O	17.5		1M, 1T	R				25			1.6	2	Ad	400	
			M	D			O	O	18.3		1M, 1T		0.9	327	SE	18		A				75	0.9
							O	O															
					T		O, G	O, G														80	
7.1	Tu	Me	M	V	M	D	SS(196)	C	13.5	2150	1M, 1T	R										230	
		O			T		G		1.1		3T	S											
		O	T	D			WH															120	0.5
0		O	MT	S, D			UF(128)	C	12.8	2300	3T	S, R	0.5		SE	5						150	
4.7	Tu		MT	V	MT	V	O, G	O	18.5		1M, 1T	S										20	
						Ma	G	G	1.0		2T	S, R											
			M				O	O			1M											14	
17.6	Tu		T	D	T	D	G¹, O	G¹, O			2T	S										66	
	Pl					D	G	G	1.0													105	1.0
			M	V		D	SS	C	10.8	2350	2M, 1 MT	R	0.5	5000	Wo	5		A				50	
			T	D	T	D	O, G	O, G			1M, 1T												
			T	T, S	T	T, S	O, G	O, G														1,050	16
		Me	MT	V	MT	S, D	SS(384)	C	11.0	2200			1.0	3600	MI		1	A	1.3	2	Cu	64	2.5
					M		O, G	G	1.0		2M												
							O	O														15	
			M	V			O	O			2M	R										42	
				D	M		G	G	1.0		1M, 2T	S, R											
			M	V	M	D	O	O														100	
0			MT	D	O	D	O, G	O	18.4		1M, 1 Du	R										746	
			T				O, G¹																
			T	Hy	T	Hy	UF	C, O, G			1T	R										150	0.5
							O	O														98	
			T	D	T	D	O	G	1.0		2T												
			T				O, G																
							SS(154)	C														34	
0		Me	MT	D	MT	D	SS	C	12.0		1M, 1T, 1 Du	S, R		3600	WE							80	
							SS(110)	C															
3.1	Tu	Me	T	D	T	D	HF, O	HF	4.5		1M, 2 Du	S, R										50	
3.5	Tu	Me	M	D	M	D	SS(157)	C	13.5		1M, 1T	R											
			M	V			TG	C															
			T	D	T	D	O, G	O	17.9				0.4		EI							37	
							SS	C														120	
1.7			M	D	M	D	O	O															
			MT		MT		SS	O			1M, 1T		0.8	3600	GE	10	0	A				65	1.9
2.6	Tu		T	D	T	S, D	O	Li	6.7	2050												120	
	Tu	Me	M	V	M	D	SS(128)	O	18.5													88	
	Tu	Me	M	D	M	D	SS(61)	C	12.8	2808	1M, 1 Du	R										73	
	O	O	M	S, D	M	S, D	O	C	11.6		1 Du	R										150	2.0
	Pl		M	Hy	M	D	P	C			1M, 1T		1.3	5000	Wo	3.5	1	A				350	5.1
0			M	D			O, G	C	14.0	2400	M, T	R										228	3.8
4.8	Tu	Me	M	V	2 Mp	D	SS(174)	C, O	13.5	2500	2M	R										90	
			M	D		D	UF(88)	G	1.0		1M, 2T	R	2.0	3600	WE	5	0	A					
			MT	Hy	MT	D, Hy	UF	C	12.8	2400	2 Du	R										50	
0			M	V	M	D	SS(198)	C			1M, 2 Du	R		1750	To							300	1.8
9.5	Tu	E	M	D	T	S, D	P	C			1M, 1T	R											
			M	D	M	Hy	BL	C, WW			2M, 1T	R											
			M				O	O, BL			1M, 1T	R										135	
			T	S, D			SS	G¹	4.1		3T	S, R											
							SS																
							UF	C															
			T				O	O	18.5													21.6	
			M	D	M	D	O, G	O	18.4		2 Du											28	
			M	D			O	G	1.0		2 Du	R										100	
0			M	V			SS	O	18.9		1M, 1T, 1 Du	R											
			T	D			SS	C			3 Du	R										47.5	
			T	D				C															

Ox – Maschinen Fabrik Oerlikon
P – Pulverized-fuel firing
Pl – Plate
R – Regulator
RS – Riley Stoker Corp
S – Speed control
SE – Skinner Engine Co
SS – Spreader stoker
ST – Step Top

T – Turbine drive
Te – Terry Steam Turbine Co
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
Vo – Henry Vogt Machine Co
W – Wood
WH – Waste heat

WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
Wi – Wickes Boiler Co
Wo – Worthington Pump & Machy Corp, Moore Steam Turbine Division
WW – Wood waste

¹–Blast-furnace gas
²–Future coal
³–Flat grate
⁴–Steam-heated
⁵–Gas-air heater
⁶–Blast-furnace, natural and coke-oven gases
⁷–Bagasse
⁸–Pitch
⁹–Steam engines
¹⁰–Coke breeze
¹¹–From zinc-concentrator roasting
(ESD–Stoker grate area, sq ft

1950 Design Survey of Typical Industrial and

Compiled by J C McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation, new units	Nominal pressure, psi	Nominal steam temperature, F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Heating surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface, per boiler, 1000 sq ft
Northampton State Hospital	Northampton, Mass	E C Brown Co	5-50	250	Sat	1	35	EC	4.6	0.9	.....	DB	.....
Owens-Corning Fiberglas	Newark, Ohio		1949	250	482	1	40	CE	6.8	.....	.....	.....	.....
L W Packard Co	Ashland, N.H.	G H Perkins	11-49	250	Sat	1	30	Bi	5.0	1.6	25.0	.....	.....
Pure Carbonic Inc	Chicago, Ill.	R N Palmquist	1948	250	Sat	1	30	CE	.....	.....	.....	.....	.....
Raleigh State Hospital	Raleigh, N.C.	Wiley & Wilson	1951	250	501	2	50	BW	16.8	.....	30.0	DB	0
						1	25	BW	.....	.....	.....	DB	0
Remington Arms Co	Ilion, N.Y.		1948	250	.....	2	25	CE	.....	.....	.....	.....	.....
Revere Copper & Brass	Detroit, Mich.		.....	250	.....	2	22	CE	7.9	.....	.....	.....	.....
Rockford Drop Forge	Rockford, Ill.	Lockwood Greene	1950	250	.....	2	30	CE	.....	.....	.....	.....	.....
Safety Car Htg & Ltg Co	New Haven, Conn		1949	250	Sat	1	5	Bi	.....	.....	.....	.....	.....
Shellmar Products Co	Mt Vernon, Ohio	Ralph Spengler	1948	250	366	1	30	BW	3.9	1.2	33.6	DB	0
Spaulding Fibre Co	Tonawanda, N.Y.		1949	250	Sat	2	32.5	CE	.....	.....	.....	.....	.....
Sprague Electric Co	North Adams, Mass	F P Sheldon & Sons	1949	250	397	3	25	BW	.....	.....	.....	.....	.....
Standard-Coosa-Thatcher Co	Rossville, Ga		1-50	250	Sat	1	15	CE	.....	.....	.....	.....	.....
Susquehanna Mills, Inc	Sunbury, Pa	Franklin Engrg	1948	250	Sat	2	35	CE	5.5	.....	25.0	DB	.....
United Chemical & Organic Products	Calumet City, Ill.		1949	250	371	1	40	BW	6.2	.....	.....	.....	0
United Rayon Mills	Elberton, Ga		1949	250	Sat	1	20	CE	.....	.....	.....	.....	.....
United States Rubber Co	Naugatuck, Conn		1949	250	366	3	35	Wi	5.5	1.6	26.5	.....	0
U S Vanadium Corp	Rifle, Colo		.....	250	Sat	1	15	RS	.....	.....	.....	.....	.....
Univ of Florida	Tallahassee, Fla		1948	250	Sat	1	31	BW	3.9	.....	.....	.....	.....
Univ of Houston	Houston, Texas		1950	250	Sat	2	27	CE	3.9	.....	.....	.....	.....
Univ of Kentucky	Lexington, Ky	Proctor & Ingles	1950	250	477	2	60	BW	7.8	2.7	.....	.....	.....
						1	20	BW	3.1	0.8	.....	.....	.....
Univ of Maryland	College Park, Md	Egli & Gompf	1948	250	Sat	1	100	RS	12.4	5.4	22.0	DB	.....
Univ of Oregon	Eugene, Ore	J. Donald Kraeker	10-50	250	500	3	35	CE	6.9	1.9	22.7	.....	.....
Upper Snake River Valley Dairy Assn	Idaho Falls, Idaho	Power Engrg Co	1948	250	350	1	23	CE	3.9	.....	.....	.....	0
Western Gypsum Co	Sigurd, Utah		1948	250	396	1	40	BW	5.7	.....	.....	.....	.....
200 TO 249 PSI													
Brown Knitting Co	Warsaw, N.Y.		1949	240	353	1	22	WB	2.6	0.9	27.6	.....	.....
Ross & Roberts, Inc	Stratford, Conn		11-49	230	Sat	1	5	Bi	.....	.....	.....	.....	.....
Budd Co	Detroit, Mich.		1949	225	366	1	120	BW	11.5	6.3	.....	.....	.....
Cornell Dubilier Elec Corp	New Bedford, Mass		1949	225	388	1	15	BW	2.4	.....	.....	.....	.....
Dan River Mills	Danville, Va	United Engrs & Constr Corp	9-50	225	500	1	100	CE	14.5	7.1	17.5	DB	.....
Esso Standard Oil Co	Everett, Mass		1950	225	485	3	80	RS	8.6	4.0	25.0	DB	0.3
Massachusetts Inst of Tech	Cambridge, Mass	Jackson & Moreland	11-50	225	490	2	70	Wi	8.4	3.1	28.6	.....	2.6
McCarthy Chemical Co	Winnie, Texas		1948	225	387	3	70	UI	.....	.....	.....	.....	.....
Minnesota State Hospital	Fergus Falls, Minn		1950	225	Sat	1	28	RS	4.0	1.4	.....	.....	.....
Ohio State Univ	Columbus, Ohio	Sargent & Lundy	1951	225	615	1	80	BW	6.7	4.4	24.3	DB	3.0
Villanova College	Villanova, Pa	Gilboy & O'Malley	.....	220	.....	2	30	CE	5.5	1.5	28.5	.....	0
Dominion Alkali & Chem Co	Beauharnois, Quebec		1949	213	360	2	18	CB	2.5	.....	.....	.....	.....
Howard Smith Paper Mills, Ltd	Montreal, Quebec		1948	213	Sat	1	15	CB	.....	.....	.....	.....	.....
American Forge Co	Niles, Calif.		1948	200	Sat	1	24.6	EC	.....	.....	.....	.....	.....
Belcher Oil Co	Miami, Fla		1949	200	Sat	1	17	CB	2.1	.....	.....	.....	.....
Bowser, Inc	Fort Wayne, Ind		1949	200	Sat	2	25	EC	3.9	.....	30.0	.....	.....
Briggs Mfg Co	Youngstown, Ohio		1950	200	366	1	74	BW	7.6	2.7	.....	.....	.....
Buffalo State Hospital	Buffalo, N.Y.		1950	200	364	4	53.5	BW	8.3	.....	.....	.....	.....
Canadian Pacific Rwy	Montreal, Que		1950	200	495	2	20	FW	.....	.....	.....	.....	.....
Celina Stearic Acid Co	Celina, Ohio		.....	200	Sat	1	18	Vo	.....	.....	.....	.....	.....
Crown Zellerbach Co	West Linn, Oregon		.....	200	500	2	120	BW	10.0	5.0	33.6	.....	0
						1	170	BW	13.6	6.0	33.6	.....	0
Dalhousie Univ	Halifax, Nova Scotia	EngrgServ Co	1950	200	Sat	2	15	FW	.....	.....	.....	.....	.....
D Norman Beatty Memorial Hosp	Westville, Ind		1950	200	366	3	40	UI	6.0	1.8	.....	.....	.....
Foote Mineral Co	Exton, Pa		10-49	200	Sat	1	21	EC	3.5	1.0	26.0	DB	.....
Gilet Carbonizing Co	Lowell, Mass		1948	200	Sat	2	17	CB	.....	.....	.....	.....	.....
Girard College	Philadelphia, Pa		1949	200	366	1	12	BW	2.5	.....	.....	.....	.....
						1	28	BW	5.0	.....	.....	.....	.....
Hotel Dennis	Atlantic City, N.J.	Pannell & Wiltburger	9-50	200	Sat	1	14	Bi	.....	.....	.....	.....	.....
International HarvesterCo	West Pullman, Ill.	E K Moore	1950	200	377	1	60	Vo	8.4	2.4	31.0	.....	.....
Minneapolis-Moline Co	Moline, Ill.		1948	200	370	2	25	Mi	4.0	.....	.....	.....	.....
Moose Lake State Hospital	Moose Lake, Minn	Toltz, King & Day	1950	200	378	1	24	UI	3.5	1.1	27.5	.....	0
Morgan Dyeing & Bleaching Co	Rochelle, Ill.	E H Cassan	1949	200	366	1	30	BW	.....	.....	.....	.....	.....
New York & Pennsylvania Co	Lock Haven, Pa		1949	200	500	1	70	EC	8.5	3.2	30.9	.....	.....
New York & Pennsylvania Co	Willsboro, N.Y.		3-50	200	Sat	2	8	EC	4.1	.....	.....	.....	.....
Oswego Falls Corp	Fulton, N.Y.	Burns & Roe	1950	200	415	3	50	RS	6.9	2.2	28.1	DB	1.1
Paraffine Co	Metuchen, N.J.		1950	200	365	2	40	BW	.....	.....	.....	.....	.....
Reeves Mfg Co	Dover, Ohio	Paul Prince & Assoc	1949	200	Sat	2	40	EC	5.8	1.8	29.0	DB	.....
Rock Island Refining Corp	Rock Island, Ind		1950	200	470	1	36	Vo	5.3	2.1	25.0	.....	.....
St Joseph's Hospital	Lancaster, Pa		9-50	200	353	3	13.5	BW	2.5	0.5	.....	.....	.....
St Peter State Hospital	St Peter, Minn	Toltz, King & Day, Inc	1-50	200	Sat	1	28	EC	5.0	1.3	28.0	DB	.....
Sears Roebuck & Co	Seattle, Wash	H W Beecher	.....	200	Sat	2	22	BW	6.5	.....	.....	.....	.....
A G Spaulding & Bros, Inc	Chicopee, Mass		11-50	200	Sat	1	16	Bi	.....	.....	.....	.....	.....
State Penitentiary	Jefferson City, Mo	Fitzpatrick & Nash	2-50	200	Sat	2	28	Wi	2.8	0.7	51.5	DB	0
Stauffer Chemical Co	Niagara Falls, N.Y.		1949	200	366	1	45	BW	6.8	.....	.....	.....	.....
Sunl-Citrus Products Co	Haines City, Fla		.....	200	.....	1	25	EC	.....	.....	.....	.....	.....
U S Dept of Interior	Rifle, Colo		1950	200	385	1	15	UI	2.5	0.7	29.3	.....	.....
U S Tobacco Co	Chicago, Ill.		1948	200	378	1	40	BW	6.5	.....	.....	.....	.....
Univ of Alberta	Edmonton, Alta		1950	200	382	2	50	FW	.....	.....	.....	.....	.....
Univ of Toronto	Toronto, Ont	H G Acres	1951	200	387	2	75	JI	8.0	4.1	21.7	.....	.....
Walla Walla College	Walla Walla, Wash	E F Gross	1949	200	Sat	2	20	EC	6.2	0.6	.....	DB	.....
Wells Linen Supply Co	Springfield, Mass		1948	200	Sat	1	22	RS	3.3	.....	.....	.....	.....
Western Milk Co-op	Rochester, N.Y.		1949	200	.....	1	4	CB	.....	.....	.....	.....	.....
Westinghouse Elec Corp	Hyde Park, Mass		1950	200	371	2	30	BW	3.7	1.0	.....	.....	0

Institutional Power Plants: 200 Psi and Above

Air-heater surface, per boiler, 1000 sq ft	Air-heater type	Dust collectors	F–D FANS: Drive	F–D FANS: Air-volume control	I–D FANS: Drive	I–D FANS: Gas-volume control	Firing	FUEL: Type	FUEL: Heating value, 1000 Btu per lb	FUEL: Ash-fusion temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of bleed pts	Generator cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity (incl non-unit units), 1000 lb	Total generator capacity (incl non-unit units), 1000 kw
.....	.....	Mo	MT	S, V	MT	S, D	UF	C	14.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	165	.....
.....	.....	.....	.....	.....	M	D	SS(137)	C	11.5	.....	1M, 1T	S, R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	80	.....
.....	Tu	Mo	M	.....	.....	D	TG	C	.....	.....	3M, 1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	125	1.0
0	.....	Mo	M	D	M	Hy	SS(306)	C	13.7	2400	2M, 1T	Hy	1.0	5000	Wo	4.7	0	A	.....	.....	.....	.....	.....
0	.....	.....	M	D	M	Hy	.....	C	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44	.....
.....	.....	.....	.....	.....	.....	.....	SS	C	12.7	.....	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	.....
.....	Tu	Mo	M	D	MT	D	UF(70)	C	.....	.....	2M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	Tu	.....	M	D	M	D	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45	.....
.....	.....	.....	.....	.....	.....	.....	O	O	12.0	2200	3Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	140	.....
0	.....	O	MT	V	.....	D	SS(86)	C	.....	.....	2Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	M	D	.....	.....	UF	C	13.3	2100	1M, 1Du, 1MT	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	.....
.....	.....	Mo	T	S	T	S, D	SS	C	13.5	.....	2M, 1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45	.....
.....	.....	.....	M	D	.....	.....	UF	C	11.0	.....	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	70	.....
.....	.....	Mo	M	D	M	D	TG(180)	An	.....	.....	3T	S, R	0.2	3600	Mi	4	1	.....	.....	.....	.....	85.6	1.5
0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	24	.....
.....	.....	Mo	M	Hy	M	Hy	SS(50)	C	18.3	.....	1M, 1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	105	.....
0	.....	.....	M	V	.....	D	O	O	12.0	.....	2T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13	.....
.....	Tu	.....	M	.....	M	.....	SS	C	.....	.....	2Du	S, R	.....	.....	.....	.....	.....	.....	.....	.....	.....	111	.....
.....	.....	.....	T	.....	.....	D	O	O	1.0	.....	1M, 2T	Hy	.....	.....	.....	.....	.....	.....	.....	.....	.....	54	.....
.....	.....	.....	M	D	MT	D	G	G	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	Mo	T	S	T	S	SS(152)	C	13.5	2400	4T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	269	.....
.....	.....	.....	T	S	T	S	G	G	1.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	200	.....
11.5	Tu	Mo	MT	.....	MT	D	P	C, O	13.5	.....	2M, 2T	R	1.5	3600	Wo	1.0	1	A	1.7	2	Ad	105	3.0
.....	Tu	Mo	M	S	M	S	HF	HF, O	4.5	.....	1M, 2T	.....	1.5	3600	Wo	35	0	A	.....	.....	.....	.....	.....
.....	.....	.....	M	V	M	.....	SS(108)	C	12.5	2500	2Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	.....
.....	.....	Mo	M	D	M	.....	SS	C	13.2	2240	1T, 1Du	S, R	.....	.....	.....	.....	.....	.....	.....	.....	.....	40	.....
.....	.....	.....	.....	.....	.....	.....	SS	C	13.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	250	.....
.....	.....	.....	.....	.....	.....	.....	P	C	14.0	2700	1M, 3T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	428	12.9
15.9	Tu	Mo	MT	D	T	.....	UF	C	14.5	2900	2Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	240	.....
.....	.....	Mo	M	.....	.....	.....	P	C	14.2	2700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	190	2.7
8.6	Tu	Mo	M	V	M	D	O	O	.....	.....	1M, 2T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	210	.....
6.6	Tu	.....	.....	T	T	V	O	O	18.1	.....	1M, 3T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	48	0.9
.....	.....	.....	T	S	T	S	O	O	1.0	.....	3T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	T	D	T	.....	G	G	13.8	.....	1Du, 1M, 1T	.....	0.9	1200	Mi	5	1	A	.....	.....	.....	465	14
.....	.....	.....	M	.....	.....	D	SS	C	12.0	2200	1T	R	5.0	3600	GE	.....	1	A	6.0	2	Mo	60	.....
0	.....	Mo	M	D	M	D	SS(182)	C	11.7	.....	2Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	36	.....
0	.....	Mo	M	D	.....	D	TG(179)	An	14.0	.....	1M, 1Du	S, R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	M	V	M	V	UF(26)	C	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38	.....
.....	.....	.....	.....	.....	M	D	O	O	.....	.....	1M	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50	.....
.....	.....	.....	.....	.....	.....	.....	O	O	14.0	2800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	74	.....
.....	.....	.....	.....	.....	.....	.....	SS(72)	C	.....	.....	1M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	214	1.3
.....	.....	.....	M	D	.....	.....	O	O	18.0	.....	2T, 1Du	.....	1.3	3600	.....	10	.....	A	.....	.....	.....	.....	.....
.....	.....	.....	T	D	.....	D	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	280	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	Mo	M	D, V	.....	D	ww, O	HF	4-8.0	.....	3T	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	410	.....
0	.....	.....	T	S	T	S	ww, O	HF	4-8.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15.0	Tu	.....	T	S	T	S	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30	.....
.....	.....	.....	M	D, V	.....	.....	TG(128)	C	.....	2170	3M	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	120	1.2
.....	.....	.....	M	V	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	M	D	.....	.....	O	O	.....	.....	2M	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	60	.....
.....	.....	.....	M	V	.....	.....	TG(71)	An	12.5	2800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	M	V	.....	.....	TG(154)	An	12.5	2800	2T, 1Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	96	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	135	.....
.....	.....	Mo	M	D	.....	D	TG(168)	C	11.5	2250	1M, 2T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	48	.....
.....	.....	Mo	Mi	D	.....	.....	SS(94)	C	11.5	2000	2°	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	72	1.1
0	.....	.....	M	D	.....	.....	UF(68)	C	13.0	2400	2°	R	0.7	4500	Mi	5.0	1	A	1.0	2	Br	45	11
.....	.....	2Mp	V	.....	MT	.....	O, G	O, G	.....	.....	1M	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	570	17
.....	.....	Mo	M	V	M	V	SS	C	12.5	2800	2M, 2T	S, R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	WH	WH	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	150	10
0	.....	Mo	M	V	T	S	SS(144)	C	13.5	2400	2M	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	M	V	M	D	O	O	.....	.....	4M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	65	.....
.....	.....	.....	M	V	.....	.....	SS(123)	C	11.0	.....	1M, 1Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	T	D	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	M	V	.....	D	UF(43)	C	14.2	2800	2M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	M	V	.....	.....	O, G	O, G	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	Mo	M	D	.....	.....	SS	C, O	.....	.....	M	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	ww, O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
0	.....	M	V	.....	.....	.....	O, G	O	.....	.....	2M	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	56	.....
0	.....	Mo	M	D	M	D	SS(146)	C	.....	.....	1M, 1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	.....
.....	.....	.....	.....	.....	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	T	V	T	D	O	O	18.0	.....	.....	S	.....	.....	.....	.....	.....	.....	.....	.....	.....	88	1.3
.....	Tu	.....	T	.....	.....	.....	TG(144)	C, G	.....	.....	1T, 2Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	172	0.8
.....	.....	.....	.....	.....	.....	.....	O, G	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	150	.....
7.0	Tu	.....	M	V	M	D	P	C	12.0	2000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40	0.3
.....	.....	Mo	T	S	T	S	SS	C	12.0	.....	3Du	S, R	.....	.....	.....	.....	.....	.....	.....	.....	.....	22	0.3
.....	.....	.....	M	V	M	D	O	O	18.5	.....	2Du	R	0.3	400	Al	3.5	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60	.....
1.8	Tu	.....	M	V	M	V	O	O	18.4	.....	2M, 1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

1950 Design Survey of Typical Industrial and

Compiled by J C McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation new units	Nominal pressure, psi	Nominal steam temperature, F	BOILERS Number	BOILERS Capacity, each 1000 lb per hr	BOILERS Manufacturing	Firing	TURBINES Capacity 1000 kw	TURBINES Speed, rpm	TURBINES Manufacturer	TURBINES Backpressure	TURBINES No. of bleed pts	Total boiler capacity, incl new units, 1000 lb	Total generator capacity incl new units, 1000 kw
161 TO 199 PSI																
Westmoreland Hospital Assn	Greensburg, Pa	E. D. Tucker	1950	196	338	1	11	UI	UF(56)	.....	.....	.....	.....	..	24	....
Canadian National Rwys	No. Battleford, Sask		1949	192	327	1	6	.....	.....	.....	.....	.....	.....	..	.....	....
Canadian National Rwys	Hudson Bay Junction, Sask		1949	192	327	1	6	.....	.....	.....	.....	.....	.....	..	.....	....
Canadian National Rwys	Drumheller, Alta		1949	192	327	1	6	.....	.....	.....	.....	.....	.....	..	.....	....
York Knitting Mills	Woodstock, Ont		1950	192	353	2	6	CV	UF	.....	.....	.....	.....	..	.....	....
U.S. Penitentiary	McNeil Island, Wash		1949	185	480	1	13.8	Ke	An	1.0	4500	Wo	1.0	1	44.9	2.1
Crane Co	Chicago, Ill	Sargent & Lundy	1949	180	373	1	75	BW	SS(166)	.....	.....	.....	.....	..	.....	....
Flintkote Co	East Rutherford, N. J	R. R. Imsande	1950	180	440	1	30	RS	.....	.....	.....	.....	.....	..	60	....
Roanoke Mills Co	Roanoke Rapids, N. C		.....	180	Sat	2	40	RW	SS	.....	.....	.....	.....	..	80	....
U.S. Veterans Administration	Sawtelle, Calif		2-50	180	375	2	50	UI	O,G	.....	.....	.....	.....	..	117	....
Zion's Co-op Mercantile Inst	Salt Lake City, Utah		.....	180	460	1	18.5	UI	O,G	1.0	200	SE	6.0	..	50	1.0
Delaware, Lackawanna & Western RR	Hoboken, N. J		1950	175	378	1	60	FW	O	.....	.....	.....	.....	..	240	....
Native Lace Co	Dallas, Pa		1948	175	Sat	1	18	IB	TG	.....	.....	.....	.....	..	.....	....
Noranda Mines	Noranda, Que		10-51	175	525	1	22.5	JI	WH	.....	.....	.....	.....	..	.....	....
U.S. Plywood Corp	Orangeburg, S.C	Lockwood Greene	.....	175	Sat	1	17	BW	WW	.....	.....	.....	.....	..	.....	....
W. J. Jetta Co	Montreal, Que		1950	171	.....	2	18	CV	O	.....	.....	.....	.....	..	.....	....
Episcopalienne Corp	Ottawa, Ont		1950	170	.....	2	24	CV	O	.....	.....	.....	.....	..	.....	....
Sharpe & Dohme Inc	North Wales, Pa		1950	170	Sat	2	40	CE	O	.....	.....	.....	.....	..	.....	....
National Institutes of Health	Bethesda, Md		1952	165	.....	3	150	EM	O	.....	.....	.....	.....	..	450	....
151 TO 160 PSI																
Acton Rubber Co	Actonvale, Que		.....	160	Sat	1	15	CV	UF	.....	.....	.....	.....	..	.....	....
Adelphian Academy	Holly, Mich	R. Cole	1949	160	363	1	12.5	WB	C	.....	.....	.....	.....	..	25	....
						1	12.5	WB	O							
Allied Kid Co	Wilmington, Del		1949	160	331	1	17	BW	O	.....	.....	.....	.....	..	.....	....
Allis Chalmers Mfg. Co	West Allis, Wis	F. G. Schmid	.....	160	470	1	175	RS	P	7.4	3600	AC	.....	..	672	12
						2	150	RS	P							
Arkport Dairies	Arkport, N. Y		1950	160	Sat	1	20	EC	O	.....	.....	.....	.....	..	.....	....
Aron Canning Co	Stockton, Calif		1949	160	Sat	1	30	EC	O	.....	.....	.....	.....	..	.....	....
Babcock & Wilcox Co	Alliance, Ohio		1949	160	353	2	25	BW	UF	.....	.....	.....	.....	..	50	....
Bailey Meter Co	Cleveland, Ohio		1948	160	.....	1	10	BW	UF	.....	.....	.....	.....	..	.....	....
Ballantine Brewing Co	Newark, N. J		1949	160	350	2	35	BW	O	.....	.....	.....	.....	..	90	....
Beecher Falls Mfg. Corp	Beecher Falls, Vt		1951	160	Sat	2	23	Wi	W	0.2	200	SE	12	..	23	0.9
Bon Secours Hospital	Grosse Point, Mich		1950	160	Sat	1	11	EC	O	.....	.....	.....	.....	..	.....	....
Brigham Young Univ	Provo, Utah	Earl Gritton	2-50	160	.....	1	21	UI	P	.....	.....	.....	.....	..	.....	....
Brown & Williamson Tobacco Corp	Petersburg, Va		2-50	160	Sat	1	20	RS	TG	.....	.....	.....	.....	..	.....	....
Butler Cnty Memorial Hospital	Butler, Pa	Fosdick-Helmer	1950	160	338	2	20	BW	UF	.....	.....	.....	.....	..	40	....
Butler & Ullman, Inc	Hadley, Mass		1948	160	324	1	16.5	BW	UF	.....	.....	.....	.....	..	.....	....
H. F. Byrd, Inc	Berryville, Va		1949	160	Sat	1	16	EC	O	.....	.....	.....	.....	..	40	....
Carlisle Tire & Rubber Co	Carlisle, Pa		1950	160	Sat	1	16	EC	SS	.....	.....	.....	.....	..	26	....
Chicago Natural History Museum	Chicago, Ill		1950	160	338	2	20	BW	TG	.....	.....	.....	.....	..	50	....
Chicago Pneumatic Tool Co	Frankfort, N. Y		1949	160	338	3	20	BW	SS	.....	.....	.....	.....	..	60	....
Chicago Screw Co	Bellwood, Ill		1949	160	338	3	16.5	BW	O	.....	.....	.....	.....	..	49.5	....
City of Baltimore Airport	Baltimore, Md		1949	160	Sat	2	25	EC	O	.....	.....	.....	.....	..	50	....
City of Chicago	Chicago, Ill		7-50	160	347	3	29	WB	.....	.....	.....	.....	.....	..	.....	....
Coca Cola Co	Baltimore, Md		1949	160	338	1	16	BW	O	.....	.....	.....	.....	..	.....	....
Concord Steam Corp	Concord, N. H		1-50	160	Sat	1	25	RS	O	.....	.....	.....	.....	..	60	....
Corps of Engineers	Albuquerque, N. M	Black & Veatch	1949	160	338	2	33	BW	O,G	.....	.....	.....	.....	..	.....	....
Cuyahoga Soap Co	Cleveland, Ohio		.....	160	338	1	9	BW	UF	.....	.....	.....	.....	..	.....	....
Davidson College	Davidson, N.C	Wm. Wallace II	1950	160	Sat	1	20.8	CE	UF	.....	.....	.....	.....	..	.....	....
Denver Sewer Pipe & Clay Co	Denver, Colo		.....	160	358	1	27	BW	SS	.....	.....	.....	.....	..	.....	....
						1	20	BW	SS							
M. H. Detrick Co	Aurora, Ill		1949	160	353	1	15	BW	O,G	.....	.....	.....	.....	..	.....	....
Diamond Pwr. Specialty Co	Lancaster, Ohio	Austin Co	1950	160	338	2	6	BW	UF	.....	.....	.....	.....	..	12	0
Doctors' Hospital	New York, N. Y		1949	160	338	2	17	BW	O	.....	.....	.....	.....	..	66	....
Durham High School	Durham, N. C		1950	160	353	1	16	BW	UF	.....	.....	.....	.....	..	.....	....
Euclid Road Machinery Co	Euclid, Ohio	Mayer & Valentine	1950	160	Sat	2	20	EC	UF	.....	.....	.....	.....	..	40	....
Export Leaf Tobacco Co	Richmond, Va		1948	160	Sat	1	36	EC	O	.....	.....	.....	.....	..	90	....
Export Leaf Tobacco Co	Wilson, N. C		1950	160	Sat	2	14	EC	O	.....	.....	.....	.....	..	.....	....
Warren Featherbone Co	Three Oaks, Mich		1949	160	353	1	13	BW	UF	.....	.....	.....	.....	..	.....	....
Forest Products Treating Co	Dallas, Ore		1949	160	Sat	2	16	EC	SS	.....	.....	.....	.....	..	32	....
Gallo Winery	Modesto, Calif	G. E. Rahm	9-50	160	Sat	1	26	Bi	O,G	.....	.....	.....	.....	..	.....	....
General Electric Co	Bridgeville, Pa		1949	160	338	1	12	BW	UF	.....	.....	.....	.....	..	20	....
General Electric Co	Circleville, Ohio		1949	160	Sat	2	25	EC	UF	.....	.....	.....	.....	..	50	....
Glen Raven Cotton Mills	Glen Raven, N. C		1949	160	Sat	1	20	EC	O	.....	.....	.....	.....	..	.....	....
Goodjohn Sash & Door Co	Leavenworth, Kan		1949	160	353	1	10	BW	WW	.....	.....	.....	.....	..	10	....
Greenwood Mills	Greenwood, S. C	McPherson & Co	1950	160	344	2	10	BW	UF	.....	.....	.....	.....	..	.....	....
Grinnell Corp	Providence, R. I		1949	160	312	1	20	BW	O	.....	.....	.....	.....	..	.....	....
A. Gross & Co	Newark, N. J		1949	160	Sat	1	35	RS	SS	.....	.....	.....	.....	..	75	....
Hamilton Mfg. Co	Columbus, Ind		1950	160	.....	1	24	Ve	TG	.....	.....	.....	.....	..	.....	....
Harding Carpets, Ltd	Brantford, Ont		10-50	160	125	1	15	FW	UF	.....	.....	.....	.....	..	30	....
Haudaille-Hershey Corp	Decatur, Ill		1949	160	338	2	15	BW	O,G	.....	.....	.....	.....	..	56	....
Iroquois Beverage Corp	Buffalo, N. Y		3-50	160	Sat	2	21	UI	SS	.....	.....	.....	.....	..	42	....
Ithaca Gun Co., Inc	Ithaca, N. Y		1950	160	320	1	10	BW	TG	.....	.....	.....	.....	..	.....	....
Kraft Foods, Inc	Kendallville, Ind		1949	160	Sat	2	16	EC	O	.....	.....	.....	.....	..	32	....
Lancaster General Hospital	Lancaster, Pa		1949	160	Sat	2	16	EC	UF	.....	.....	.....	.....	..	.....	....
Land O'Lakes Creamery	Marshfield, Wis		1949	160	Sat	2	20	EC	SS	.....	.....	.....	.....	..	40	....
Land O'Lakes Creamery	Whitehall, Wis		1949	160	Sat	3	60	EC	SS	.....	.....	.....	.....	..	22	....
Lehigh Valley Farmers Co-op	Allentown, Pa		1948	160	350	2	11	UI	TG	.....	.....	.....	.....	..	.....	....
Libby-McNeil-Libby	Gridley, Calif		1949	160	Sat	1	32	EC	O	.....	.....	.....	.....	..	.....	....

AC – Allis-Chalmers Mfg Co
An – Anthracite
Bi – Bagasse
BL – Black liquor
BW – Babcock & Wilcox Co
C – Coal, bituminous
CB – Cleaver-Brooks Co
CE – Combustion Engineering Superheater Inc
CV – Canadian Vickers Ltd
D – Dresser
DL – DeLaval Steam Turbine Co
EC – Erie City Iron Works
El – Elliott Co
EM – Edge Moor Iron Works Inc
FW – Foster Wheeler Corp
G – Gas
GE – General Electric Co
HF – Hogged Fuel
IB – International Boiler Works
JI – John Inglis Co Ltd
JL – James Leffel & Co
Ke – E Keeler
KB – Kewanee Boiler Corp
MI – Murray Iron Works Co

Institutional Power Plants: Below 200 Psi

Compiled by J. C. McCabe, Associate Editor

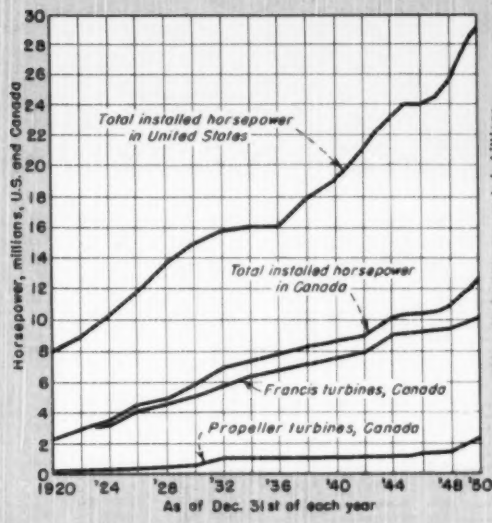
Company	Location	Consulting Engineers	First operation, new units	Nominal pressure, psi	Nominal steam temperature, °F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Fuels	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. of bleed pts	Total boiler capacity (not new units), 1000 lb	Total generator capacity (not new units), [illegible] kw
Libby-McNeil-Libby	Sunnyvale, Calif.		1948	160	Sat	(1	8	EC)							59.7	
						(1	19	EC)								
						(1	32	EC)								
Liberty Hosiery Mills, Inc.	Gibsonville, N.C.		1949	160	Sat	1	10	EC	UF						10	
Liebmann Breweries, Inc.	Brooklyn, N. Y.		1949	160	480	1	50	BW	O						120	
Lincoln Electric Co.	Euclid, Ohio		1950	160	Sat	2	36	EC	SS						45	
Locke Insulator Corp.	Baltimore, Md.		1949	160	338	1	26	BW	SS						26	
Loyola Univ.	Chicago, Ill.		1949	160	353	2	18	BW	O						36	
Lucky Lager Brewing Co.	Azusa, Calif.		1950	160	353	1	16	BW	O						28	
Manning, Maxwell & Moore	Stratford, Conn.		1949	160	358	1	16	BW	O						27	
Marymount Hospital	Garfield Heights, Ohio		1949	160	353	2	13.5	BW	O						27	
McLouth Steel Co.	Trenton, Mich.		1949	160	353	2	31	BW	O						62	
Memorial Hospital	Houston, Texas		1950	160	Sat	2	17.3	CE	G						34.6	
Mills College	Oakland, Calif.	Hudson & Grazy	1950	160	338	1	25	BW	O,G						38	
Mohawk Paper Mills	Cohoes, N. Y.		1949	160	Sat	1	25	EC	UF						55	
Monarch Laundry	Chicago, Ill.	E. Casson	1949	160	Sat	1	30	CE	SS						50	
Mt. St. Mary's Hospital	Niagara Falls, N. Y.	J. Fruchtbaum	1949	160	Sat	2	20	EC	UF						20	
Mt. Sinai Hospital	Minneapolis, Minn.		1950	160	Sat	2	20	RS	O,G							
Victor Monaghan Co.	Greenville, S. C.	J. P. Stevens & Co.	1949	160	353	2	18	BW	SS						36	
Moor Bath Hotel	Waukesha, Wis.		1950	160	344	1	13	BW	O						25	
Niles Glass Works	Niles, Ohio		1949	160	353	1	36	BW	UF							
North Carolina College	Durham, N. C.		1950	160	Sat	2	30	EC	UF						30	
North Texas State College	Denton, Texas	Yandell, Cowan, Love Engr. Co.	10-49	160	Sat	2	9	Vo	G							
Norwalk State Hospital	Norwalk, Calif.		1949	160	Sat	1	33	EC	O						67	
Oakland County Service Co.	Pontiac, Mich.	Hyde & Babbie		160	Sat	3	22	EC	O						27	
Ohio Rubber Co.	Long Beach, Calif.		4-50	160	Sat	1	20	EC	O,G						78.6	
Oregon State Hospital	Salem, Ore.	Thos. Taylor	1950	160	353	3	26	BW	O HF						40	
Pacific Colony State Hospital	Spadra, Calif.			160	370	1	20	UI	O						11	
Pacific Lumber Agency	Sumner, Wash.		1949	160	Sat	1	6	EC	HF							
Pacific States Cast Iron Pipe Co.	Provo, Utah		1949	160	Sat	2	10	EC	O,G							
Peralta Hospital	Oakland, Calif.	Garthorne, Buenaccorsi, Murry	1950	160	Sat	2	14	EC	O,G							
Pesco Products Co.	Redford, Ohio		1950	160	Sat	2	40	EC	SS						40	
Peter Paul Inc.	Naugatuck, Conn.		11-50	160	Sat	2	9	Bi	O							
Pilgrim State Hospital	Brentwood, N. Y.		1949	160	370	...	70	UI	UF	2.5	3600	Wo	5	..	420	
Polyclinic Hospital	Cleveland, Ohio		1949	160	Sat	2	8	EC	UF							
Providence Memorial Hospital	El Paso, Texas		1950	160	.....	2	10	Vo	O,G							
Quaker Maid Co.	Bloomdale, Ohio		1949	160	Sat	1	27	EC	SS							
Revere Copper & Brass	Baltimore, Md.		1949	160	353	2	15	BW	O						30	
Revere Copper & Brass	Rome, N. Y.		1-50	160	353	1	38	WB	SS							
Rich Ladder Mfg. Co.	Cincinnati, Ohio		1949	160	338	2	10	BW	O							
Rockwell Mfg. Co.	Freeport, Ill.		1949	160	344	2	10	BW	SS							
Rosedale Knitting Co.	Reading, Pa.	Wertz Engrg.	1948	160	350	2	18	EC	O							
St. Francis Convent	Mishawaka, Ind.		1950	160	338	2	17.5	BW	C						48	
St. John's Hospital	Brooklyn, N. Y.	Eade, Freund & Campbell	1949	160	Sat	1	14	EC	TG							
St. Joseph Hospital	Memphis, Tenn.	T. J. O'Brien	1949	160	344	2	15	BW	O							
St. Vincent's Hospital	Birmingham, Ala.	J. A. Evans	1950	160	Sat	2	8	EC	O,G							
San Bernardino County Hospital	San Bernardino, Calif.	Stockley & Bamford	1949	160	344	3	15	BW	O,G							
San Jacinto Ordnance	Houston, Texas		1949	160	Sat	2	20	EC	G							
San Lorenzo Nurseries	Los Angeles, Calif.		1949	160	Sat	1	30	EC	O							
Seelbach Hotel	Louisville, Ky.		1950	160	.....	1	30	Vo	TG							
Self Memorial Hospital	Greenwood, S. C.		1950	160	344	2	10	BW	UF							
Shaw Univ.	Raleigh, N. C.		1949	160	Sat	2	12	EC	UF							
T. S. Simms & Co., Ltd.	St. John, New Brunswick		10-50	160	Sat	1	11.5	FW	SS							
Southern Baptist Theological Seminary	Louisville, Ky.		1950	160	.....	1	15	Vo	UF							
Spalding Laundry Dry Cleaning	Louisville, Ky.		1948	160	366	1	28.5	BW	SS	0.3	225	SE			28.5	0.3
Spartan Mills	Spartanburg, S. C.		1949	160	353	2	13.8	BW	UF							
Stanford Univ.	Stanford, Calif.	G. E. Rahm	1949	160	Sat	1	26	Bi	O,G							
Texas Prison System	Huntsville, Texas		1950	160	.....	2	20	Vo	O,G						15	
Tutwailer Hotel	Birmingham, Ala.		1948	160	.....	1	5.2	UI	SS							
U. S. Atomic Energy Comm.	Albuquerque, N. M.	Black & Veatch	1950	160	350	4	60	UI	O,G						240	
U. S. Veterans Admin.	Altoona, Pa.		1949	160	353	3	13.6	BW	C							
U. S. Veterans Admin.	Fort Wayne, Ind.		1949	160	Sat	3	27	EC	O						50	
U. S. Veterans Admin.	Hot Springs, S. D.		5-50	160	338	1	25	WB	SS							
U. S. Veterans Admin.	Iowa City, Ia.		1950	160	Sat	3	16	EC	SS							
U. S. Veterans Admin.	Lexington, Ky.		1950	160	.....	3	26.4	Vo	SS							
U. S. Veterans Admin.	Little Rock, Ark.		1950	160	Sat	3	6.9	EC	O							
U. S. Veterans Admin.	Manchester, N. H.		1949	160	Sat	3	12	EC	O							
U. S. Veterans Admin.	Omaha, Neb.		1950	160	Sat	3	6.9	EC	SS						20.7	
U. S. Veterans Admin.	Phoenix, Ariz.		1950	160	Sat	3	10	EC	O							
U. S. Veterans Admin.	Poplar Bluff, Mo.		1950	160	Sat	1	8	EC	O,G							
U. S. Veterans Admin.	Portland, Ore.		1950	160	Sat	3	16	EC	O						48	
U. S. Veterans Admin.	St. Cloud, Minn.		1-50	160	337	2	25	WB	SS						45	
U. S. Veterans Admin.	Spokane, Wash.		1949	160	338	3	11	BW	O						33	
U. S. Veterans Admin.	Walla Walla, Wash.		1950	160	Sat	3	12	EC	O						36	
Univ. of Alabama	University, Alabama		1949	160	Sat	1	27.5	Vo	UF							
Univ. of Idaho	Pocatello, Idaho	Earl Gritton	1948	160	353	2	33	BW	P,C						65.8	
Univ. Of Maryland	Princess Anne, Md.	James Posey	1950	160	Sat	2	13.5	EC	UF							
Utah Canning Co.	Ogden, Utah		1950	160	353	2	12	BW	G						62	
Washington State Pen.	Walla Walla, Wash.	C. C. Moore	1949	160	347	1	18	BW	UF						72	
Wilberforce College	Wilberforce, Ohio	R. S. Curl & Assoc.	10-50	160	350	1	30	UI	SS						90	
150 TO 159 PSI																
Evenson Estate	Boston, Mass.		11-49	155	Sat	1	15	Bi	O							
Abbott Dairies	Philadelphia, Pa.		8-50	150	Sat	2	8.5	Bi	O							
Allied Mills, Inc.	Portsmouth, Va.		1948	150	360	1	5.0	CB	C							

O – Oil
P – Pulverized-fuel firing
R – Regulator
RS – Riley Stoker Corp
S – Speed control
SE – Skinner Engine Co
SS – Spreader stoker
T – Turbine drive
TG – Traveling-grate stoker
Ti – Titusville Iron Works Div
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
VK – Vickers Keeler Co
Vo – Henry Vogt Machine Co
W – Wood
WH – Waste Heat
WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
Wi – Wickes Boiler Co
Wo – Worthington Pump & Mach'y Corp, Moore Steam Turbine Division
WW – Wood waste
(150) – Stoker grate area, sq ft
(1) – Gas-engine driven

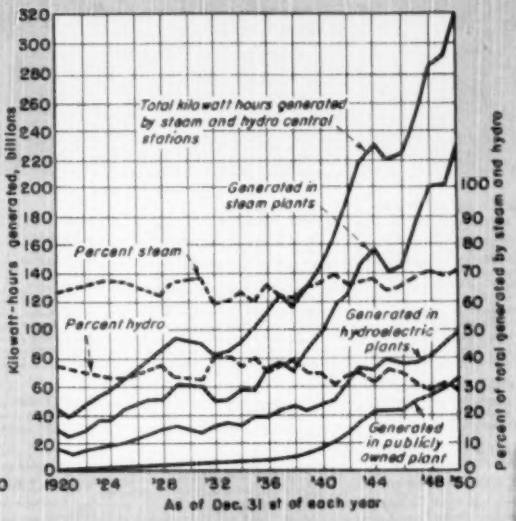
Industrials and Institutionals: Below 200 Psi

Compiled by J. C. McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation new units	Nominal pressure, psi	Nominal steam temperature, F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturing	BOILERS: Firing	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure psia	TURBINES: No. of bleed pts	Total boiler capacity, incl new units 1000 lb	Total generator capacity incl new units, 1000 kw
Balentine Packing Co.	Greenville, S. C.		1950	150	.....	2	5.8	CB	O	.....	.....	.....	.....	..	.....	....
Ballard Oil Co.	Wethersfield, Conn.		2-50	150	Sat	1	5.0	Bi	O	.....	.....	.....	.....	..	.....	....
W. B. Beach	Petersburg, Va.		9-50	150	Sat	1	9.5	Bi	O	.....	.....	.....	.....	..	.....	....
Breyer Ice Cream Co.	Long Island City, N. Y.		1949	150	.....	1	8.5	CB	O	.....	.....	.....	.....	..	.....	....
Bridgeport Industrial Serv.	Shelton, Conn.		10-50	150	Sat	1	5.0	Bi	O	.....	.....	.....	.....	..	.....	....
Brown & Williamson Tobacco	Lexington, Ky.		12-48	150	36	{1 1	9.0 16	CB JL	O,G O,G	.....	.....	.....	.....	..	.....	....
Bulova Watch	Waterbury, Conn.		7-49	150	Sat	2	7	Bi	O	.....	.....	.....	.....	..	.....	....
Burney Bros. Bakery	Chicago, Ill.		1950	150	.....	3	5.8	CB	O,G	.....	.....	.....	.....	..	94	....
Canadian Car & Foundry Co.	Montreal, Canada		.....	150	.....	1	40	FW	SS	.....	.....	.....	.....	..	.....	....
Canadian Car & Foundry Co.	Montreal, Canada		{1949 1950	150 150	Sat Sat	1 1	40 40	FW FW	SS SS	.....	.....	.....	.....	..	100	....
Canadian Pacific Rwys.	Winnipeg, Manitoba		1950	150	466	3	25	JI	SS	.....	.....	.....	.....	..	.....	....
Capitol Record, Inc.	Los Angeles, Calif.		.....	150	350	1	6.9	.....	O	.....	.....	.....	.....	..	.....	....
Carnation Co.	Sherbrooke, Que.		1950	150	.....	1	36	CV	C	.....	.....	.....	.....	..	.....	....
Chrysler Corp.	Detroit, Mich.		.....	150	.....	{1 11	5 9	CB CB	O O	.....	.....	.....	.....	..	.....	....
Commercial Solvents Corp.	Terre Haute, Ind.		.....	150	Sat	2	25	Wi	O	.....	.....	.....	.....	..	135	....
Congoleum-Nairn Co.	Cedarhurst, Md.		.....	150	366	3	35	RS	SS	.....	.....	.....	.....	..	.....	....
Crowley's Milk Co.	Paterson, N. J.		1948	150	.....	1	5.2	CB	O	.....	.....	.....	.....	..	.....	....
Dept. of Justice	Kingston, Ontario		1950	150	465	1	21	JI	UF	.....	.....	.....	.....	..	.....	....
Dickinson County Hosp.	Iron Mountain, Mich.		1950	150	.....	2	5.8	CB	O	.....	.....	.....	.....	..	.....	....
Doernbecher Mfg. Co.	Portland, Ore.		.....	150	358	1	45	RS	O,HF	0.5	3600	AC	5	..	100	0.5
Dolly Madison Dairies	Eau Claire, Wis.		1948	150	.....	1	5.2	CB	O	.....	.....	.....	.....	..	.....	....
Elliott Hospital	Manchester, N. H.	R. D. Kimball	11-49	150	Sat	{1 3	3.0 6.0	Bi Bi	O O	.....	.....	.....	.....	..	.....	....
Elmira Reformatory	Elmira, N. Y.		1949	150	366	4	16	BW	UF(96)	1.0	4500	Wo	4	0	64	1.6
Falstaff Brewing Corp.	St. Louis, Mo.		1949	150	Sat	1	48	BW	TG(110)	.....	.....	.....	.....	..	.....	....
Falls City Creamery Co.	Falls City, Nebr.		1948	150	.....	1	5.2	CB	O	.....	.....	.....	.....	..	.....	....
Fitkin Hospital	Neptune, N. J.		11-49	150	Sat	1	7.5	Bi	O	.....	.....	.....	.....	..	.....	....
Florida Tar & Creosote Corp.	Tampa, Fla.		1948	150	366	1	4.3	CB	O	.....	.....	.....	.....	..	.....	....
Ford Motor Co.	Cleveland, Ohio	Fairbrother, Miehls	1951	150	Sat	{1 3	60 100	Wi Wi	TG TG	.....	.....	.....	.....	..	360	0
Ford Motor Co.	Cincinnati, Ohio	Fairbrother, Miehls	1950	150	Sat	3	25	Wi	UF	.....	.....	.....	.....	..	75	0
Gladding, McBean & Co.	Glendale, Calif.		1948	150	Sat	1	17	CB	O,G	.....	.....	.....	.....	..	.....	....
Interlake Tissue Mills Co.	Merriton, Ont.		1949	150	416	1	33	FW	.....	.....	.....	.....	.....	..	.....	....
Joliet Arsenal	Joliet, Ill.		1950	150	.....	2	5.8	CB	O	.....	.....	.....	.....	..	.....	....
Keeler State Street Restaurant	Albany, N. Y.	A. E. Offner	1-51	150	Sat	2	4	Bi	O	.....	.....	.....	.....	..	.....	....
Lone Star Brewing Co.	San Antonio, Tex.		1949	150	Sat	1	16	EC	O,G	.....	.....	.....	.....	..	.....	....
Marlin Rockwell Corp.	Plainville, Conn.		8-50	150	Sat	1	14	Bi	O	.....	.....	.....	.....	..	.....	....
H. McLachlan & Co.	Danbury, Conn.		11-49	150	Sat	1	7.5	Bi	O	.....	.....	.....	.....	..	.....	....
Michigan Milk Producers	Imlay City, Mich.		5-50	150	Sat	2	12	Bi	C	.....	.....	.....	.....	..	.....	....
Mohican Hotel	New London, Conn.		8-49	150	Sat	1	4	Bi	O	.....	.....	.....	.....	..	.....	....
Neo-Gravure Printing Co.	Weehawken, N. J.		1950	150	.....	3	8.7	CB	O	.....	.....	.....	.....	..	.....	....
Northern Engraving & Mfg.	La Crosse, Wis.		1950	150	.....	4	5.8	CB	O	.....	.....	.....	.....	..	.....	....
Nottage Laundry	Brooklyn, N. Y.		9-50	150	Sat	1	8.5	Bi	O	.....	.....	.....	.....	..	.....	....
Perkins Institution	Watertown, Mass.	Hollis French	8-50	150	Sat	4	8.5	Bi	O	.....	.....	.....	.....	..	.....	....
Power & Combustion Inc.	Baltimore, Md.		6-50	150	Sat	1	4	Bi	O	.....	.....	.....	.....	..	.....	....
Reilly Tar & Chemical Co.	Fairmont, W. Va.	H. R. Horner	1949	150	Sat	2	17	CB	G	.....	.....	.....	.....	..	.....	....
Ridgeview Farms Dairy	Chicago, Ill.		1949	150	Sat	1	6.9	CB	O,G	.....	.....	.....	.....	..	9	....
St. Joseph's Hospital	St. Joseph, Mich.		1950	150	.....	3	7	CB	O	.....	.....	.....	.....	..	.....	....
St. Lawrence State Hosp.	Ogdensburg, N. Y.		9-51	150	365	4	40	Ti	SS	1.0	1200	Wo	.....	..	160	1.0
Schoitz Memorial Hospital	Waterloo, Iowa		1950	150	.....	2	7	CB	O	.....	.....	.....	.....	..	.....	....
Stokely Foods, Inc.	Indianapolis, Ind.		1949	150	Sat	1	50	RS	SS(126)	.....	.....	.....	.....	..	.....	....
Swedish American Hospital	Rockford, Ill.		1950	150	.....	2	8.7	CB	O	.....	.....	.....	.....	..	.....	....
Truett Hospital, Baylor Univ.	Dallas, Texas		1950	150	Sat	{1 2	5 5	EC BW	G G	.....	.....	.....	.....	..	.....	....
United Shoe Machy. Corp.	South Middletown, Mass.		9-50	150	Sat	1	11	Bi	O	.....	.....	.....	.....	..	.....	....
United States Rubber Co.	Manchester, N. H.		1949	150	365	2	2	CB	O	.....	.....	.....	.....	..	.....	....
Van Raalte Co., Inc.	Bryson City, N. C.		.....	150	Sat	1	8	EC	C	.....	.....	.....	.....	..	.....	....
Verona Chemical Co.	Newark, N. J.		1950	150	Sat	2	5.8	CB	O	.....	.....	.....	.....	..	.....	....
Winnebago State Hospital	Winnebago, Wis.	Gates, Moe & Weiss	11-50	150	Sat	3	12	UI	UF	.....	.....	.....	.....	..	.....	....
R. L. Ziegler, Inc.	Tuscaloosa, Ala.		9-50	150	Sat	1	7.5	Bi	O	.....	.....	.....	.....	..	.....	....
(149 PSI AND BELOW)																
Beatty Bros. Ltd.	Fergus, Ont.	Taylor Engrg.	12-49	145	355	1	40	FW	SS(129)	.....	.....	.....	.....	..	.....	....
Van Raalte, Inc.	Athens, Tenn.		.....	140	Sat	1	5	CE	SS(30)	.....	.....	.....	.....	..	.....	....
All Steel Equipment, Inc.	Aurora, Ill.		1949	125	.....	2	12	CB	O,G	.....	.....	.....	.....	..	.....	....
Alloy Metal Sales, Ltd.	Toronto, Ont.		.....	125	.....	1	4	JI	UF	.....	.....	.....	.....	..	.....	....
American Can Co.	Chatham, Ont.		11-50	125	Sat	2	20	JI	O	.....	.....	.....	.....	..	.....	....
Canadian National Rwy.	Harnepayne, Ontario		1950	125	Sat	2	9	.....	SS	.....	.....	.....	.....	..	.....	....
Carol-May Finishing Co.	Concord, N. C.		1948	125	Sat	1	4.3	CB	O	.....	.....	.....	.....	..	.....	....
Dayton State Hospital	Dayton, Ohio	Carl Larimer	1950	125	Sat	1	17.5	UI	UF	.....	.....	.....	.....	..	.....	....
Dept. of Public Wks.	Smith Falls, Ont.		.....	125	Sat	3	25	JI	SS	.....	.....	.....	.....	..	.....	....
Honeoye Falls Cream Prod.	Honeoye Falls, N. Y.		1948	125	.....	1	6	CB	O	.....	.....	.....	.....	..	.....	....
Johnson Steel & Wire Co.	Worcester, Mass.		1948	125	.....	1	5.2	CB	O	.....	.....	.....	.....	..	15	....
H. E. Koontz Creamery, Inc.	Baltimore, Md.	Lester Gardner	1948	125	Sat	1	5	IB	O	.....	.....	.....	.....	..	.....	....
Reliance Electric & Engrg Co.	Ashtabula, Ohio		.....	125	Sat	1	10.5	CB	O	.....	.....	.....	.....	..	.....	....
Southern Cotton Oil Co.	Memphis, Tenn.		.....	125	Sat	3	33	CE	G	.....	.....	.....	.....	..	.....	....
U. S. Veterans Admin.	Rutland Heights, Mass.		1948	125	.....	1	4.3	CB	O	.....	.....	.....	.....	..	26	....
Thomas Young Greenhouses	Bound Brook, N. J.	P. H. Oppenheimer	1949	125	Sat	3	15	.....	UF	.....	.....	.....	.....	..	.....	....
Slippery Rock State Tchrs. Coll.	Slippery Rock, Pa.	Rust Engrg.	1951	120	Sat	2	20	.....	UF	.....	.....	.....	.....	..	.....	....
Bridgeport Pipe & Engrg. Co.	Bridgeport, Conn.	Fletcher Thompson	11-50	100	Sat	4	6.5	Bi	O	.....	.....	.....	.....	..	.....	....
Canadian Car & Foundry	Montreal, Canada		1-50	100	Sat	1	15	JI	O	.....	.....	.....	.....	..	18	....
Cravenette Co. of U.S.A.	Hoboken, N. J.		.....	100	250	{1 1	16 6	CB CB	O O	.....	.....	.....	.....	..	.....	....
Cyclewald Cement Prod.	Trenton, Mich.	Giffels & Vallet	.....	100	292	2	10.5	CB	O	.....	.....	.....	.....	..	.....	....
Douglas & Lomason Co.	Detroit, Mich.	C. S. Harrison	.....	100	Sat	1	.....	.....	.....	.....	.....	.....	.....	..	.....	....
Hollinger Gold Mines	Timmins, Ont.		1949	100	388	1	20	FW	HF	.....	.....	.....	.....	..	.....	....
Reliance Electric & Engrg Co.	Ashtabula, Ohio		1948	100	Sat	1	7	CB	O	.....	.....	.....	.....	..	.....	....
Warren Petroleum Co.	Maysville, Okla.	Dresser Engrg.	10-49	.....	.....	...	.....	.....	.....	2.0	327	EI	.....	..	.....	....


Horsepower, millions, U.S. and Canada
Total installed horsepower in United States
Total installed horsepower in Canada
Francis turbines, Canada
Propeller turbines, Canada
1920 '24 '28 '32 '36 '40 '44 '48 '50
As of Dec. 31 of each year

CAPACITY: Total hydroelectric power installed in U. S. and Canada in last 30 years. The U. S. added 3,600,000 in the past two years


Kilowatt-hours generated, billions
Percent of total generated by steam and hydro
Total kilowatt hours generated by steam and hydro central stations
Generated in steam plants
Percent steam
Percent hydro
Generated in hydroelectric plants
Generated in publicly owned plant
1920 '24 '28 '32 '36 '40 '44 '48 '50
As of Dec. 31 of each year

POWER generated in U. S. steam and hydro central stations; kwhr each class of plant supplied; also percent of total each provided

Hydro Hits New Highs in 1949-50

Water-power developments in U. S. and Canada have reached their fastest growth during the last two years. In the U. S., nearly 2,000,000 hp went into service in 1949, and 1,600,000 hp were added this year. This total of 3,600,000 hp is by far the greatest increase for any like period in the industry's history. As curves show, total installed capacity is now 29,100,000 hp, nearly double that in 1930. Tables, pp 102-107, list 124 projects under construction or completed in the last two years.

Because of the tremendous growth of U. S. power load, hydroelectric generation is scarcely holding its own percentage-wise. This year (1950) total generation will be about 325-billion kwhr, of which hydroelectric plants will supply 96-billion kwhr, a little over 29%. This is the lowest percentage except in 1948. If load-growth predictions are realized, hydro will continue to supply an even smaller part of the total.

New Construction. Much of the hydro construction increase in the last 20 years has been in plants of Federal government agencies. Table on page 108 shows how much this is. Listed are all government hydro plants except municipal. Here are 89 projects with an ultimate capacity of over 20,000,000 hp of which nearly 16,000,000 have been installed or are on order. Construction has been started on practically all these plants during the last 17 years.

Columbia River and its tributaries in the Pacific Northwest have been the sites of much of the government hydroelectric construction. Besides the 3,250,000 hp put into operation, plants are under construction with a total capacity of 5,350,000 hp to go into operation in the next ten years. Plans call for construction of twelve more projects in the same period with a capacity of 3,000,000 hp. When all these are completed, 11,500,000 hp will be installed in government plants on the Columbia. Over 7,000,000 hp of this will be in three plants: Grand Coulee, 3,012,000 hp completed in 1951; McNary, 1,558,000 hp scheduled for operation in 1953; Chief Joseph, 2,700,000 hp scheduled to start in 1956. Besides the Federal government, public utility companies in the Pacific Northwest and Seattle plan to add, in the next ten years, nearly 1,000,000 hp of new hydro capacity.

Power Generation. TVA continues to be the largest power-generating system in the world, with an output of over 17-billion kwhr last year, over 16-billion of which was from hydro plants. During the same period, Bonneville and Grand Coulee plants on the Bonneville Power Administration's system generated over 14-billion kwhr, of which Grand Coulee supplied nearly 10.5-billion. Peak load on these two plants reached 2,106,000 kw.

Canada's Hydro. As in the U. S., hydroelectric developments in Canada hit new highs in 1949 and '50. Table, pp 106, 107, lists 44 projects that went into operation or were under construction in the last two years. Indications are that central-station power generation will exceed 50-billion kwhr in 1950, an increase of 5-billion over 1948.

Last year nearly 500,000 hp of new hydro capacity went into operation, bringing installed capacity to 11,613,-000 hp. This year capacity going to service will reach nearly 1,000,000 hp. About 50% of this is represented by the Des Joachims 500,000-hp plant of the Hydro-Electric Commission of Ontario, on the Ottawa River, which went into operation in July.

Biggest water-power event in Canada this year was ratification of the treaty with the U. S. that makes it possible to redevelop the Niagara River and use the increased diversion. Hydro-Electric Commission of Ontario has plans under way that will increase power generation 1,400,000 hp on the Canadian side of the river.

United States Hydroelectric Plants Put in

Compiled by F A Annett, Associate Editor

Company or government agency	Design or consulting engineers	Project name	[1]New or redeveloped	River	State	Project started, date	[2]Dam type	Crest length, ft	Max height, ft	Date of initial operation	Initial capacity, hp
NEW ENGLAND STATES											
New England Power Co	Chas T Main, Inc	Wilder	Red.	Connecticut	N.H.&Vt.	1947	CG	1,000	59	1950	48,000
Central Maine Power Co	New England Power Service Co	Williams	New	Kennebec	Me.	1937	CGG	340	35	1939	10,150
Rumford Falls Power Co		Upper Station	Red.	Androscogan	Me.	1949	.....	.....	.....	1950	.....
Bangor Hydro Electric Co	Bangor Hydro-Electric Co	Milford No. 4A	Red.	Penobscot	Me.	1948	.....	.....	.....	1949	2,600
American Woolen Co		Browns Mill	.....	.....	Me.	1948	.....	.....	.....	1949	.....
Lyndonville Electric Dept	Chas T Main, Inc	Vail	Red.	Passumpsic	Vt.	1949	.....	.....	.....	1949	530
Metropolitan District Comm	Metropolitan District Comm	Oakdale	New	Swift & Ware	Mass.	1947	.....	.....	.....	1949	5,225
Holyoke Water Power Co	Jackson & Moreland	No. 3 Station	Red.	Connecticut	Mass.	1949	GM	1,020	30	1951	22,000
Ames Worsted Co		Southbridge	Red.		Mass.	1947	.....	.....	.....	1949	515
Ames Worsted Co		Southbridge	Red.		Mass.	1947	.....	.....	.....	1949	540
Ponemah Mills		Taftville	.....		Conn.	1948	.....	.....	.....	1950	1,300
MIDDLE ATLANTIC STATES											
Niagara Mohawk Power Corp		Stewart Bridge	Red.	Sacandaga	N.Y.	1947	Earth	1,650	112	1952	42,500
Central Hudson Gas & Elec Corp	Chas T Main, Inc	Neversink	New	Neversink	N.Y.	1948	[3]EF	2,800	200	1952	41,000
Brownville Board Co		Brownville	Red.		N.Y.	1949	.....	.....	.....	1950	451
EAST NORTH CENTRAL STATES											
Ohio Public Service Co		Burger	New		Ohio	1948	.....	.....	.....	1948	1,870
U. S. Corps of Engineers	U. S. Corps of Engineers; Erik Floor & Associates	St. Mary's Falls	New	St. Mary's	Mich.	1947	.....	.....	.....	1951	23,925
Dairyland Power Cooperative	Fargo Engineering Co	Dairyland Dam	New	Flambeau	Wis.	1948	C&EF	5058	100	1950	26,400
Northern States Power Co	Pioneer Service & Engr Co	Holcombe	New	Chippewa	Wis.	1948	CG	462	68	1950	48,000
Wisconsin River Power Co	Harza Engineering Co	Petenwell	New	Wisconsin	Wis.	1947	CG	.....	52	1949	28,800
Wisconsin River Power Co	Harza Engineering Co	Castle Rock	New	Wisconsin	Wis.	1948	CG	.....	38	1950	22,000
Wisconsin Michigan Power Co	Mead & Hunt	Big Quinnesec Falls	New	Menominee	Wis.	1948	CG	640	72	1949	22,000
City of Kaukauna Elec & Wtr Dept	Mead, Ward & Hunt	Little Chute	New		Wis.	1946	.....	.....	.....	1949	4,980
Northern Wisconsin Power Co	Loeb & Eames	Orienta Falls	Red.	Iron	Wis.	1947	CG	267	54	1949	1,150
Green Bay & Mississippi Canal Co		Old Badger	.....		Wis.	1948	G	.....	.....	1950	3,030
Northwestern Wisconsin Elec Co	Herman Hagestad	Danbury Canal	Red.	Yellow	Wis.	1947	CG&EF	.....	58	1950	960
WEST NORTH CENTRAL STATES											
Minnesota Power & Light Co	Ebasco Services, Inc	Thomson	New	St. Louis	Minn.	1907	CG&EF	.....	.....	1910	39,000
U. S. Corps of Engineers	U. S. Corps of Eng; Chas T Main	Garrison	New	Missouri	N.D.	1947	Earth	12,000	210	1955	176,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Erik Floor & Associates	Fort Randall	New	Missouri	S.D.	1946	Earth	10,000	160	1954	230,000
Northwest Paper Co	Haslett & Erdal	Cloquet	Red.	St. Louis	Minn.	1948	CG	190	40	1949	4,887
Bladen Paper Co		Grand Rapids	New		Minn.	1948	.....	.....	.....	1949	1,900
Bowersock Mill & Power Co		Lawrence	Red.		Kan.	1948	.....	.....	.....	1949	320
Consumers Public Power Dist		Spencer	Red.	Niobrara	Neb.	1947	.....	.....	.....	1949	3,040
SOUTH ATLANTIC STATES											
Alexandria Water Co		Alexandria	New		Va.	1949	.....	.....	.....	1950	550
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Buggs Island	New	Roanoke	Va.&N.C.	1947	CG	22,357	144	1952	175,200
U. S. Corps of Engineers	U. S. Corps of Engineers	Philpott	New	Smith	Va.	1948	CG	920	220	1951	19,640
Rocky Mount Mills	Rocky Mt.		New		N.C.	1949	.....	.....	.....	1950	1,285
Carolina Aluminum Co	Aluminum Co of America	Cheoah	New	Little Tenn	N.C.	1916	CA	750	221	1919	112,000
Nantahala Power & Light Co	Aluminum Co of America	Queens Creek	New	Queens Creek	N.C.	1947	RFEF	328	76	1949	2,250
Nantahala Power & Light Co	Aluminum Co of America	Tuckasegee	New	Tuckasegee	N.C.	1949	Arch	326	72	1950	3,915
South Carolina Pub Service Auth		Santee Spillway	New	Santee	S.C.	1947	.....	.....	.....	1949	2,720
U. S. Corps of Engineers	U. S. Corps of Eng; Chas T Main	Clark Hill	New	Savannah	S.C.&Ga.	1947	CG	5,660	200	1953	385,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Sanderson & Porter	Allatoona	New	Etowah	Ga.	1946	CG	1,325	210	1949	102,900
U. S. Corps of Engineers	Harza Engineering Co; U. S. Corps of Engineers	Buford	New	Chattahoochee	Ga.	1949	Earth	1,630	195	1954	118,400
Habersham Mills		Habersham	Red.		Ga.	1949	.....	.....	.....	1949	330
Georgia Power Co	Southern Services, Inc; S H Woodward	Furman Shoals	New	Oconee	Ga.	1950	CG&EF	2,732	102	1952	60,000
Georgia Power Co	Stone & Webster; Charles T Main, Inc	Bartlett's Ferry	New	Chattahoochee	Ga.	1924	CG&EF	2,000	147	1926	66,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Jim Woodruff	New	Chattahoochee	Fla.	1949	CG&EF	6,084	107	1953	42,000
EAST SOUTH CENTRAL STATES											
Alabama Power Co	Dixie Construction Co	Mitchell Dam	New	Coosa	Ala.	1921	CG	1,100	106	1923	72,000
Tennessee Valley Authority	Tennessee Valley Authority	Pickwick Landing	New	Tennessee	Tenn.	1935	CGE	7,715	113	1938	96,000
Tennessee Valley Authority	U. S. Corps of Engineers; Hugh L. Cooper & Co	Wilson also Muscle Shoals	New	Tennessee	Ala.	1918	CGG	4,500	95	1926	260,000
Tennessee Valley Authority	Tennessee Valley Authority	Wheeler	New	Tennessee	Ala.	1933	CGG	6,335	68	1936	90,000
Tennessee Valley Authority	Tennessee Valley Authority	Guntersville	New	Tennessee	Ala.	1935	CG	3,985	94	1940	102,000
Tennessee Valley Authority	New Extension; Tennessee Valley Authority	Hales Bar	New	Tennessee	Tenn.	1905	CG	2,315	112	1913-15	86,000
Tennessee Valley Authority	Tennessee Valley Authority	Chickamauga	New	Tennessee	Tenn.	1936	CG	5,794	108	1940	108,000
Tennessee Valley Authority	Tennessee Valley Authority	Fort Loudoun	New	Tennessee	Tenn.	1940	CGG	4,196	122	1943	88,000
Tennessee Valley Authority	Tennessee Valley Authority	South Holston	New	South Holston	Tenn.	1942	R&E	1,550	290	1950	49,500

U. S. Waterpower Tables

[1]The term "New" applies to an entirely new project on a site that has not been developed before.

"Redeveloped" indicates a project on a site that has been developed before and now has new wheels, settings and generators, or a new plant.

[2]CG, concrete gravity; CA, concrete arch; C&E, concrete and earth; CG & EF, concrete gravity and earth fill; CGG, concrete gravity with gates; EF, earth fill; GM, granite masonry; MA, multiple arch; RFEF, rock fill with earth face; R&E, rock and earth fill; HEF, hydraulic earth fill; RFTC, rock-filled timber crib.

[3]AC – Allis-Chalmers Mfg Co
BL – Baldwin Locomotive Works
IM – I P Morris
JL – James Leffel & Co
MS – S Morgan Smith Co

Operation or Under Construction in 1949-50

Added cap. No. of units	Date of added cap.	Ultimate capacity, hp	No. of units installed	Waterwheel capacity, hp	Waterwheel type	Speed, rpm	Static head, ft	Design head, ft	*Waterwheel manufacturer	†Governor manufacturer	Scroll case, concrete or steel	Penstock valve, type	Generator capacity, kva	Synchronizing manual or auto	†Thrust-bearing location	Design power factor	Kilovolts	Cycles	‡Generator manufacturer
.....	.....	48,000	2	24,000	Kaplan	112.5	53	49	MS	W	Concrete	Head gt	18,000	Manual	BG	0.90	13.8	60	AC
1	1951	18,950	1	10,150	Kaplan	150	44	44	MS	W	Concrete	Head gt	8,000	Manual	AG	0.88	6.9	60	GE
			1	8,800	Kaplan	171.4	44	44	MS	W	Concrete	Head gt	6,500	Manual	AG	0.93	6.9	60	GE
.....	.....	.....	1	6,000	Francis	400	97	97	BL		Unit being rebuilt		4,500	Manual	HS	0.90	4.16	60	WE
.....	.....	.....	1	2,600	Kaplan	120	20	20	MS	W	Concrete	Head gt	2,000	Automatic	AG	0.80	4.16	60	GE
.....	.....	.....	1	695	Francis	164	22	22	AC	.....	Closed flume	Head gt	593	Manual	AG	0.80	2.4	60	GE
.....	.....	530	1	530	Kaplan	240	18	18	MS	W	Concrete	Head gt	438	Automatic	AG	0.80	2.4	60	GE
.....	.....	5,225	1	5,225	Francis	327	178-100	107	MS	W	Plate st	Dow disk	4,375	Auto. or Man.	BG	0.90	13.8	60	GE
.....	.....	88,000	1	22,000	Kaplan	128.5	52.5	52.5	MS	W	Concrete	Head gt	18,750	Auto. or Man.	AG	0.80	13.8	60	GE
.....	.....	515	1	515	Francis	150	18	18	JL	W	Concrete	Head gt	438	Manual	AG	0.80	2.3	60	EM
.....	.....	540	1	540	Francis	190	20.5	20.5	JL	W	Concrete	Head gt	438	Manual	AG	0.80	2.3	60	EM
.....	.....	1,300	2	650	Francis	225	27	27	JL	W	Concrete	Head gt	438	Manual	AG	0.80	2.4	60	WE
.....	.....	42,500	1	42,500	Francis	105.9	100	97	BL	.....	.....	Head gt	37,500	Manual	BG	0.80	13.8	60	GE
.....	.....	41,000	1	41,000	Francis	300	551-463	474	NN	W	Cast st	Butterfly	31,250	Manual	AG	0.80	13.8	60	GE
.....	.....	431	1	451	Francis	145	20	20	JL	.....	Concrete	Head gt	Drives mill machinery		.....	.....	.....	...	.....
1	1949	2,805	1	935	Francis	200-165	40-20	40-20	MS	.....	Concrete	Head gt	Drives Worthington centrifugal pump						
.....	.....	72,750	3	6,975	Propeller	80	23-18	21	AC	W	Concrete	Head gt	5,333	Manual	BG	0.90	13.8	60	GE
			1	3,000	Kaplan	128.5	23-18	21	MS	W	Concrete	Head gt	2,500	Manual	BG	0.90	4.16	60	GE
.....	.....	26,400	3	8,800	Kaplan	225	68	65	MS	W	Concrete	Head gt	6,250	Manual	BG	0.80	4.16	60	EC
.....	.....	48,000	3	16,000	Propeller	120	45-20	45	BL	W	Concrete	Head gt	12,500	Automatic	BG	0.90	6.9	60	WE
.....	.....	28,800	4	7,200	Kaplan	163.6	42	42	MS	W	Concrete	Head gt	6,250	Manual	AG	0.80	7.2	60	GE
.....	.....	22,000	5	4,400	Kaplan	150	28	28	MS	W	Concrete	Head gt	3,750	Automatic	AG	0.80	4.16	60	AC
.....	.....	33,000	2	11,000	Francis	200	92-85	92	AC	W	Plate st	Head gt	8,889	Automatic	BG	0.90	6.9	60	AC
.....	.....	4,980	3	1,660	Kaplan	112.5	14	14	MS	W	Concrete	Head gt	1,375	Manual	AG	0.80	2.4	60	EM
.....	.....	1,150	1	1,150	Francis	277	55	55	JL	W	Plate st	Head gt	1,000	Manual	AG	1.00	2.4	60	EM
.....	.....	3,030	2	1,515	Francis	180	22	22	MS	.....	Concrete	Head gt	.....	Manual	.....	0.80	.....	60	GE
.....	.....	960	1	960	Francis	300	38	38	JL	W	Concrete	Head gt	750	Manual	AG	0.80	2.4	60	IE
2	1914-18	89,000	3	13,000	Francis	375	345-355	355	AC	IM	Plate st	Butterfly	11,250	Manual	AG	0.80	6.6	60	GE
.....	.....		2	15,000	Francis	375	345-355	355	IM	IM	Plate st	Butterfly	12,800	Manual	AG	0.80	6.6	60	GE
1	1949		1	20,000	Francis	400	345-355	355	MS	W	Plate st	Butterfly	15,000	Manual	AG	0.80	6.6	60	GE
.....	.....	440,000	2	88,000	Francis	90	187-100	150	BL	.....	Plate st	Head gt	84,200	Manual	BG	0.95	13.8	60	.....
.....	.....	460,000	4	57,500	France	87.5	145-76	112	AC	.....	Plate st	Head gt	42,100	Manual	BG	0.95	13.8	60	WE
1	1949	6,437	1	2,500	Kaplan	240	21	21	MS	W	Concrete	Head gt	2,250	Manual	AG	0.80	2.4	60	WE
.....	.....	1,900	1	1,900	Propeller	150	20	20	AC	W	Open flume	Head gt	1,875	Manual	AG	0.80	2.4	60	EM
.....	.....	320	1	320	Francis	120	14	14	JL	.....	Open flume	Head gt	Connects to existing GE generator						
.....	.....	3,740	1	2,200	Kaplan	120	21	21	MS	W	Concrete	Head gt	2,000	Manual	AG	0.80	4.6	60	WE
.....	.....	550	1	550	Francis	450	48	48	JL	.....	Concrete	Head gt	.....	Manual	.....	0.80	.....	60	GE
.....	.....	328,200	3	51,000	Francis	85.5	108-60	90	NN	W	Plate st	Head gt	35,555	Manual	BG	0.90	13.8	60	WE
.....	.....		1	19,000	Francis	138.5	108-60	90	BL	W	Plate st	Head gt	13,333	Manual	BG	0.90	13.8	60	WE
.....	.....		2	1,600	Francis	450	108-60	90	JL	W	Service unit	.....	1,250	Manual	AG	0.80	0.48	60	WE
.....	.....	19,640	2	9,400	Francis	277	177-109	152	JL	W	Plate st	Head gt	7,500	Manual	AG	0.90	13.8	60	GE
			1	840	Francis	720	177-109	152	JL	.....	Service unit	.....	750	Manual	AG	0.80	0.48	60	GE
			1	885	Francis	200	23	23	JL	.....	Concrete	Head gt	.....	.....	.....	.....	.....	...	GE
.....	.....	1,285	1	400	Francis	200	23	23	JL	.....	Concrete	Head gt	.....	.....	.....	.....	.....	...	GE
1	1949	157,000	4	28,000	Francis	171.5	189	189	AC	AC	Plate st	Head gt	21,050	Manual	AG	0.95	13.8	60	AC
			1	45,000	Francis	164	189	189	AC	AC	Plate st	Head gt	37,500	Manual	AG	0.80	6.9	60	AC
.....	.....	2,250	1	2,250	Impulse	600	1000-925	990	MS	W	.....	Head gt	1,800	Manual	HS	0.90	2.4	60	EC
.....	.....	3,915	1	3,915	Francis	360	120	118	MS	W	Welded pl st	Head gt	3,333	Manual	AG	0.90	6.9	60	EM
.....	.....	2,720	1	2,720	Francis	180	46	46	JL	W	Concrete	Head gt	2,500	.....	AG	0.80	2.4	60	GE
.....	.....	385,000	7	55,000	Francis	100	150-111	135	NN	AC	Plate st	Head gt	44,444	Manual	BG	0.90	13.8	60	GE
.....	.....	152,900	2	50,000	Francis	112.5	153-105	135	MS	W	Plate st	Head gt	40,000	Automatic	BG	0.90	13.8	60	WE
			1	2,900	Francis	450	153-105	135	JL	W	Service unit		2,500	Manual	AG	0.80	2.4	60	WE
.....	.....	118,400	2	55,000	Francis	100	150-103	136					44,444	Manual	BG	0.90	13.8	60	
.....	.....		2	8,400	Francis	277	150-103	136	.....	.....	.....	.....	6,666	Manual	BG	0.90	13.8	60	.....
.....	.....	.....	1	330	Francis	720	85	85	JL	.....	Plate st	Head gt	Connects to existing generator						
.....	.....	60,000	2	30,000	Francis	105.9	92-72	85	MS	W	Concrete	Head gt	25,000	Manual	BG	0.80	6.9	60	.....
1	1951	94,500	3	22,000	Francis	150	117-87	112	1 AC, 2 MS	W	Plate st	Head gt	18,750	Manual	AG	0.80	12.0	1 GE, 2 WE	
			1	28,500	Francis	150	117-87	112	MS	W	Plate st	Head gt	25,000	Manual	BG	0.80	6.9	60	GE
.....	.....	42,000	3	14,000	Kaplan	75	32-14	26.5	NN	W	Concrete	Head gt	11,111	Manual	BG	0.90	13.8	60	WE
1	1949	101,000	3	24,000	Francis	90	75-65	70	AC	AC	Concrete	Head gt	20,000	Manual	AG	0.87	6.6	60	GE
			1	29,000	Francis	90	75-65	70	AC	W	Concrete	Head gt	25,000	Manual	AG	0.87	6.6	60	GE
2	1942	302,000	4	48,000	Kaplan	81.8	63-29	47	AC	AC	Concrete	Head gt	40,000	Manual	BG	0.90	13.8	60	WE
2	1951		2	55,000	Kaplan	81.8	63-29	47	AC	AC	Concrete	Head gt	40,000	Manual	BG	0.90	13.8	60	WE
14	1926-43	610,000	4	30,000	Francis	100	95	92	BL	BL	Concrete	Head gt	24,000	Manual	AG	0.90	13.8	60	WE
4	1948-49		4	35,000	Francis	100	95	92	NN	W&L	Concrete	Head gt	28,000	Manual	AG	0.90	13.8	60	GE
			10	35,000	Francis	100	95	92	AC	AC&W	Concrete	Head gt	28,000	Manual	AG	0.90	13.8	60	AC
3	1949-50	360,000	8	45,000	Propeller	85.7	54-43	48	BL	W	Concrete	Head gt	36,000	Manual	BG	0.90	13.8	60	GE
1	1951	141,000	3	34,000	Kaplan	69.2	42	42	MS	W	Concrete	Head gt	27,000	Manual	BG	0.90	13.8	60	GE
			1	39,000	Kaplan	69.2	42	42	MS	W	Concrete	Head gt	27,000	Manual	BG	0.90	13.8	60	GE
			8	7,700	Francis	112.5	37.5	37.5	MS	.....	Plate st	Head gt	6,500	Automatic	AG	1.00	6.6	60	GE
2	1952	140,000	2	4,200	Francis	112.5	37.5	37.5	MS	.....	Plate st	Head gt	3,750	Automatic	AG	0.80	6.6	60	GE
			4	4,100	Francis	100	37.5	37.5	MS	.....	Plate st	Head gt	3,133	Automatic	AG	0.80	6.6	60	GE
			2	34,000	Kaplan	69.2	37.5	37.5	MS	W	Concrete	Head gt	27,000	Manual	BG	0.90	13.8	60	GE
1	1951	144,000	4	36,000	Kaplan	75	36	36	BL	W	Concrete	Head gt	30,000	Manual	BG	0.90	13.8	60	AC
2	1948-49	176,000	4	44,000	Kaplan	105.8	78-60	65	BL	W	Concrete	Head gt	35,000	Manual	BG	0.90	13.8	60	AC
....	.....	49,500	1	49,500	Francis	144	252-126	180	MS	W	Plate st	Head gt	38,888	Auto. or man.	BG	0.90	13.8	60	WE

NN – Newport News Shipbuilding & Dry Dock Co
PW – Pelton Water Wheel Co
W – Woodward Governor Co
L – Lombard Governor Co.
EC – Elliott Co

EM – Electric Machinery Mfg Co
GE – General Electric Co
IE – Ideal Electric & Mfg Co
WE – Westinghouse Electric Corp

*AG indicates that the thrust bearing is above generator; BG, thrust bearing is below generator; HS, horizontal-shaft machine.

†Dam, tunnels and steel-pipe conduits are being designed and constructed by New York City Board of Water Supply as a part of the Delaware Water System.

United States Hydroelectric Plants Put in

Compiled by F A Annett, Associate Editor — Company or government agency	Design or consulting engineers	Project name	New or redeveloped	River	State	Project started, date	Dam type	Crest length, ft	Max height, ft	Date of initial operation	Initial capacity, hp
Tennessee Valley Authority	Tennessee Valley Authority	Watauga	New	Watauga	Tenn.	1942	R&E	900	318	1949	69,000
Tennessee Valley Authority	Tennessee Valley Authority	Wilbur	New	Watauga	Tenn.	.....	CG	380	77	.....	5,640
U. S. Corps of Engineers	U. S. Corps of Engrs; Chas T Main	Dale Hollow	New	Obey	Tenn.	1942	CG	1,717	185	1948	50,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Center Hill	New	Carney Fork	Tenn.	1942	C&E	2,160	240	1952	189,525
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Wolf Creek	New	Cumberland	Ky.	1942	C&E	5,736	240	1952	377,000
WEST CENTRAL STATES											
U. S. Corps of Engineers	U. S. Corps of Engineers; L H Harza Engineering Co	Blakely Mountain	New	Ouachita	Ark.	1948	Earth	1,150	230	1954	106,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Bull Shoals	New	White	Ark.	1947	CG	2,256	284	1953	159,000
U. S. Corps of Engineers	U. S. Corps of Engineers; L H Harza Engineering Co	Norfolk Dam	New	North Fork	Ark.	1940	CG	2,631	233	1944	42,540
U. S. Corps of Engineers	U. S. Corps of Engrs; Fargo Eng Co	Narrows Dam	New	Little Missouri	Ark.	1947	CG	941	185	1950	24,000
Grand River Dam Authority	Helwig & Neuffer	Pensacola Dam	New	Grand	Okla.	1938	MA	6,100	150	1941	80,000
U. S. Corps of Engineers	U. S. Corps of Engrs; Fargo Eng Co	Fort Gibson	New	Grand	Okla.	1946	CGE	2,850	110	1953	64,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Tenkiller Ferry	New	Illinois	Okla.	1948	RE	3,000	155	1953	47,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Dennison Dam	New	Red	Okla.&Tex.	1939	EF	23,200	165	1945	58,000
Lower Colorado River Authority	Fargo Engineering Co; Lower Colorado Authority	Buchanan	New	Colorado	Texas	1936	MA	11,000	146	1938	34,000
Lower Colorado River Authority	Fargo Engineering Co	Granite Shoals	New	Colorado	Texas	1949	CG&EF	765	105	1952	66,000
Lower Colorado River Authority	Fargo Engineering Co	Marble Falls	New	Colorado	Texas	1949	CG	820	80	1952	42,000
U. S. Corps of Engineers	U. S. Corps of Engineers; Ambursen Engineering Corp	Whitney Dam	New	Brazos	Texas	1946	CG&EF	17,801	163	1952	41,400
MOUNTAIN STATES											
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Hoover Dam	New	Colorado	Ariz.&Nev.	1931	CA	1,180	730	1936	515,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Davis Dam	New	Colorado	Ariz.&Nev.	1941	R&E	1,600	135	1950	312,500
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Estes Park	New	Colo.Big Thompson	Colo.	1947	.....	.....	.....	1950	83,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Mary's Lake	New	Colo.Big Thompson	Colo.	1947	.....	.....	.....	1950	11,300
Western Colorado Power Co	Utah Power & Light Co	Tacoma	New	Animas	Colo.	1903	RFTC	730	55	1906	6,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Pole Hill	New	Colo.Big Thompson	Colo.	.....	.....	.....	.....	1953	47,500
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Flatiron	New	Colo.Big Thompson	Colo.	.....	.....	.....	.....	1953	48,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Boysen	New	Big Horn	Wyo.	1947	EF	1,000	150	1950	21,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Kortes	New	North Platte	Wyo.	1946	CG	.....	230	1949	55,500
Lower Valley Power & Light Co	.....	Freedom	New	Strawberry	Wyo.	1949	.....	.....	.....	1950	1,450
Parowan Municipal Corp	.....	Parowan	New	.....	Utah	1949	.....	.....	.....	1950	760
Springville Municipal Pr&Lt Sy	LE & EK Wiscombe	Bartholomew	New	Springs	Utah	1948	.....	.....	.....	1949	755
Springville Municipal Pr&Lt Sy	LE & EK Wiscombe	Hobble Creek	Red.	Hobble Creek	Utah	1949	.....	.....	.....	1950	450
Heber City Light & Pwr Co	Hugo Price	Snake Creek	New	Provo	Utah	1948	.....	.....	.....	1949	1,100
U. S. Corps of Engineers	U. S. Corps of Engineers; Harza Engineering Co	Fort Peck	New	Missouri	Mont.	1934	HEF	21,000	250	1943	50,000
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Canyon Ferry	New	Missouri	Mont.	1949	CG	1,000	220	1952	70,500
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Hungry Horse	New	S F Flathead	Mont.	1948	CA	2,100	520	1952	420,000
Montana Power Co	Ebasco Services, Inc	Kerr	New	Flathead	Mont.	1930	CA	385	200	1938	77,000
Idaho Power Co	Ebasco Services, Inc	Lower Salmon	New	Snake	Idaho	1946	CG	700	50	1949	95,800
Idaho Power Co	Ebasco Services, Inc	Bliss	New	Snake	Idaho	1947	CG	500	80	1949	99,600
City of Idaho Falls	.....	.....	Red.	.....	Idaho	1948	.....	.....	.....	1949	750
Village of Banners Ferry	J H Cave & H M Burcher	.....	New	.....	Idaho	1941	CA	200	90	1942	1,500
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Anderson Ranch	New	Boise	Idaho	1941	EF	1,350	330	1950	37,000
PACIFIC COAST STATES											
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Grand Coulee	New	Columbia	Wash.	1934	CG	4,500	553	1941	538,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Chief Joseph	New	Columbia	Wash.	1949	CG	2,160	220	1955	1,000,000
Pacific Power & Light Co	Ebasco Services, Inc	Merwin (was Ariel)	New	Lewis	Wash.	1929	CA	752	314	1931	61,000
City of Seattle Dept of Lig	Dr J L Savage	Ross Dam	New	Skagit	Wash.	1937	CA	1,300	[2]540	1952	360,000
City of Seattle Dept of Lig	Dr J L Savage	Gorge	Red.	Skagit	Wash.	1948	CG	180	33	1951	92,600
Pend Oreille Mines & Metal Co	.....	Metaline Falls	New	.....	Wash.	1948	.....	.....	....	.....	.....
U. S. Corps of Engineers	U. S. Corps of Engineers	McNary Dam	New	Columbia	Wash.& Ore.	1947	CG&EF	8,800	158	1954	890,400
U. S. Corps of Engineers	U. S. Corps of Engineers	Detroit	New	North Santiam	Ore.	1947	CG	1,634	384	1953	140,000
U. S. Corps of Engineers	U. S. Corps of Engineers	Big Cliff	New	North Santiam	Ore.	1950	CG	295	172	1954	26,500
California Oregon Power Co	Pioneer Service & Engr Co	Soda Springs	New	North Umpqua	Ore.	1949	CA	100	70	1951	16,000
California Oregon Power Co	Pioneer Service & Engr Co	Slide Creek	New	North Umpqua	Ore.	1949	CG	100	20	1950	25,000
California Oregon Power Co	Pioneer Service & Engr Co	Toketee	New	North Umpqua	Ore.	1946	EF	500	75	1949	55,800
Eugene Water Power Board	.....	Leaburg	New	McKenzie	Ore.	1927	Roller	330	20	1929	10,000
Eugene Water Power Board	Cornell, Howland, Hayes & Merryfield	Waterville	Red.	McKenzie	Ore.	1948	.....	.....	....	1949	11,000
Pacific Portland Cement Co	.....	Gold Hill	New	.....	Ore.	1949	.....	.....	....	1950	1,100
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Shasta	New	Sacramento	Calif.	1928	CG	3,500	560	1944	213,000

Operation or Under Construction in 1949-50

Added unit No. of units	Date of added unit	Ultimate capacity, hp	No. of units installed	Waterwheel capacity, hp	Waterwheel type	Speed, rpm	Static head, ft	Design head, ft	*Waterwheel manufacturer	*Governor manufacturer	Head gate type	Penstock valve type	Generator capacity, kva	Synchronizing control	*Transformer bank capacity	Voltage	Kilovolts	Cycles	*Generator manufacturer
....	.....	69,000	2	34,500	Francis	200	325-165	216	NN	W	Welded pl st	Butterfly	27,777	Auto.or man.	BG	0.90	13.8	60	WE
1	1950	15,340	1	9,700	Francis	180	158	158	JL	W	Plate st	Head gt	7,777	Automatic	BG	0.90	2.3	60	EC
1	1952	75,000	3	25,000	Francis	163.6	154-118	140	MS	W	Plate st	Head gt	20,000	Manual	BG	0.90	13.8	60	WE
....	.....	189,525	3	62,500	Francis	105.9	206-134	160	BL	W	Plate st	Head gt	50,000	Manual	BG	0.90	13.8	60	GE
			1	1,525	Francis	720	206-134	160	MS	W	Plate st	Head gt	1,000	Manual	AG	0.80	0.48	60	EC
....	.....	377,000	6	62,500	Francis	105.9	214-111	160	BL	W	Plate st	Head gt	50,000	Manual	BG	0.90	13.8	60	GE
			1	2,000	Francis	600	214-111	160	JL	W	Service unit	.....	1,500	Manual	AG	0.80	0.48	60	EC
....	.....	106,000	2	53,000	Francis	120	186-135	168	.....	.....	Plate st	Butterfly	41,667	Manual	BG	0.90	13.8	60	.....
....	.....	211,000	3	52,000	Francis	128.6	239-132	190	AC	.....	Welded pl st	Head gt	42,100	Manual	BG	0.95	13.8	60	AC
			2	1,500	Francis	600	239-132	190	JL	.....	Service units	Head gt	1,250	Manual	AG	0.80	0.48	60	GE
1	1949	168,540	1	42,500	Francis	128.5	202-132	160	MS	W	Plate st	Head gt	38,890	Manual	BG	0.90	13.8	60	WE
			1	540	Francis	750	202-132	160	JL	W	Service unit	Head gt	500	Manual	AG	0.80	0.48	60	WE
			1	42,500	Francis	128.5	202-132	160	MS	W	Plate st	Head gt	38,890	Manual	BG	0.90	13.8	60	WE
....	.....	36,000	2	12,000	Francis	225	154-98	132	BL	W	Plate st	Head gt	9,444	Manual	BG	0.90	13.8	60	EC
5	1941-45	120,750	5	20,000	Francis	150	135-85	115	AC	W	Plate st	Head gt	16,000	Manual	BG	0.90	13.8	60	WE
			1	750	Francis	720	135-85	115	AC	W	Cast st	Service unit	625	Manual	HS	0.80	0.48	60	WE
1	1950		1	20,000	Francis	150	135-85	115	AC	W	Plate st	Head gt	16,000	Manual	BG	0.90	13.8	60	WE
....	.....	96,000	4	16,000	Francis	100	90-56	61	BL	W	Concrete	Head gt	12,500	Auto.or man.	BC	90	13.8	60	AC
....	.....	47,000	2	23,500	Francis	150	181-104	132	MS	.....	Plate st	Butterfly	18,000	Manual	BG	0.95	13.8	60	EC
			1	56,000	Francis	90	131-75	103	MS	W	Plate st	Head gt	36,842	Manual	BG	0.95	13.8	60	WE
1	1949	282,080	2	1,040	Francis	.....	131-75	103	JL	W	Service unit	.....	750	Manual	AG	0.80	0.48	60	WE
			1	56,000	Francis	90	131-75	103	MS	W	Plate st	Head gt	36,842	Manual	BG	0.95	13.8	60	WE
1	1949	51,900	2	17,300	Francis	171.4	133-73	115	NN	W	Plate st	Head gt	12,500	Manual	BG	0.90	6.9	60	WE
			1	17,300	Francis	171.4	133-73	115	BL	W	Plate st	Head gt	12,500	Manual	BG	0.90	6.9	60	WE
...	...	66,000	2	33,000	Francis	100	83	83	BL	W	Plate st	Head gt	25,000	Auto.or man.	BG	0.90	13.8	60	GE
...	.....	42,000	2	21,000	Propeller	120	57	57	MS	W	Concrete	Head gt	16,666	Auto.or man.	BG	0.90	6.9	60	WE
....	.....	41,400	2	20,700	Francis	128.5	126-78	91.5	NN	W	Plate st	Head gt	16,667	Manual	BG	0.90	13.8	60	AC
									7 AC	W									4 WE
			9	115,000	Francis	180	584-422	520	2 PW	W	Cast st	Butterfly	82,500	Auto.or man.	AG	1.00	16.5	....	5 GE
			1	55,000	Francis	237	584-422	520	NN	W	Cast st	Butterfly	40,000	Auto.or man.	AG	1.00	13.8	60	AC
			2	3,500	Impulse	300	.....	.....	PW	W	House unit	.....	3,000	Manual	HS	0.80	2.4	60	EM
2	1951	1,857,000	3	115,000	Francis	180	584-422	520	BL	W	Cast st	Butterfly	82,500	Auto.or man.	AG	1.00	16.5	1	GE, 2 WE
			2	115,000	Francis	180	584-422	520	AC	W	Welded pl st	Butterfly	82,500	Auto.or man.	AG	1.00	16.5	60	AC
			1	70,000	Francis	257	584-422	520	NN	W	Welded pl st	Butterfly	82,500	Auto.or man.	AG	1.00	13.8	60	GE
....	.....	312,500	5	62,500	Francis	94.7	147-100	127	BL	W	Plate st	Head gt	45,000	Auto.or man.	AG	1.00	13.8	60	GE
....	.....	63,000	3	21,000	Francis	400	563-550	555	AC	W	Plate st	Butterfly	16,667	Auto.or man.	AG	0.90	6.9	60	GE
....	.....	11,300	1	11,300	Francis	327	217-207	212	NN	W	Plate st	Head gt	9,000	Automatic	AG	0.90	6.9	60	GE
			2	3,000	Impulse	300	1,000	937	PW	L			2,250	Manual	HS	0.80	4.00	60	GE
1	1949	11,000	1	5,000	Impulse	327	1,000	937	PW	W	.....	.....	4,375	Manual	HS	0.80	4.00	60	WE
....	.....	47,500	1	47,500	Francis	450	840-810	825	.....	.....	.....	.....	35,000	Remote	AG	0.95	13.8	60	.....
....	.....	96,000	1	48,000	Francis	514	1130-1000	1045	.....	.....	Cast st	.....	35,000	Auto.or man.	AG	0.90	13.8	60	.....
....	.....	21,000	2	10,500	Francis	180	112-70	96	NN	W	.....	.....	8,333	Manual	AG	0.90	6.9	60	WE
....	.....	55,500	3	18,500	Francis	240	209-158	200	AC	AC	Plate st	Ring	13,300	Auto.or man.	AG	0.90	6.9	60	EC
....	.....	1,450	2	725	Impulse	514	.....	450	MS	.....	.....	.....	625	Manual	HS	0.90	2.4	60	EM
....	.....	760	1	760	Impulse	514	.....	490	PW	.....	.....	.....	.....	.....	.....	.....	.....	.....	GE
....	.....	755	1	755	Impulse	1200	1106-	1086	MS	W	.....	Gate	625	Manual	HS	0.80	2.4	60	GE
		450	1	350	Impulse	240	176	176	MS	W	.....	Gate	375	Automatic	HS	0.80	0.48	60	GE
....	.....		1	100	Impulse	240	176	176	MS	.....	.....	.....	.....	.....	HS	0.80	0.48	60	GE
....	.....	1,100	1	1,100	Impulse	1200	1875	1875	PW	.....	.....	.....	1,000	Manual	HS	0.80	2.4	60	GE
....	.....		1	50,000	Francis	128.5	205-120	170	MS	W	Plate st	Butterfly	38,889	Manual	BG	0.90	13.8	60	AC
1	1947	150,000	1	20,000	Francis	164	205-120	170	MS	W	Plate st	Butterfly	16,667	Manual	BG	0.90	13.8	60	AC
1	1951		1	50,000	Francis	128.5	205-120	170	MS	W	Plate st	Butterfly	38,889	Manual	BG	0.90	13.8	60	AC
....	.....	70,500	3	23,500	Francis	150	160-80	125	NN	.....	Riveted pl st	Head gt	16,667	Manual	AG	1.00	6.9	60	GE
....	.....	420,000	4	105,000	Francis	180	485-262	400	AC	W	Welded pl st	Head gt	75,000	Auto.or man.	AG	1.00	6.9	60	GE
1	1949	154,000	1	77,000	Francis	112.5	191	189	NN	W	Plate st	Head gt	56,000	Manual	BG	0.90	13.8	60	WE
			1	77,000	Francis	112.5	191	189	NN	W	Plate st	Head gt	56,000	Manual	BG	0.90	13.8	60	WE
			3	21,000	Propeller	120	55.5	55.5	NN	W	Concrete	Head gt	19,800	Manual	AG	0.86	13.8	60	AC
....	.....	95,800	1	22,800	Kaplan	120	55.5	55.5	MS	W	Concrete	Head gt	19,800	Manual	AG	0.86	13.8	60	AC
			2	22,500	Propeller	128.5	70	70	NN	W	Concrete	Head gt	25,000	Manual	BG	0.86	13.8	60	WE
....	.....	132,100	1	34,600	Kaplan	128.5	70	70	MS	W	Concrete	Head gt	25,000	Manual	BG	0.86	13.8	60	WE
....	.....	.....	1	750	Francis	150	22	22	JL	.....	Concrete	Head gt	Connects to existing GE generator						
1	1949	3,000	1	1,500	Francis	720	212	200	JL	W	Concrete	Head gt	1,250	Manual	AG	0.80	2.5	60	EM
			1	1,500	Francis	720	212	200	JL	W	Concrete	Head gt	1,250	Manual	AG	0.80	2.5	60	EM
....	.....	55,500	2	18,500	Francis	277	330-173	260	JL	W	Cast st	Butterfly	15,000	Manual	AG	1.00	6.9	60	WE
9	1949-51	3,012,000	9	165,000	Francis	120	368	300	NN	W	Cast st	Head gt	120,000	Auto.or man.	AG	1.00	13.8	60	WE
			3	14,000	Francis	400	368	300	PW	W	Service unit	Head gt	10,000	Auto.or man.	AG	0.80	2.4	60	WE
			9	165,000	Francis	120	368	300	NN	W	Cast st	Head gt	120,000	Auto.or man.	AG	1.00	13.8	60	WE
....	.....	2,700,000	10	100,000	Francis	100	179-148	165	NN	.....	Plate st	Head gt	67,368	Manual	BG	0.95	13.8	60	WE
			1	61,600	Francis	240		190	MS	W	Plate st	Head gt	45,000	Manual	BG	0.80	13.8	60	WE
1	1949	252,400	1	1,050	Francis	.....	.....	190	JL	W	Service unit	.....	1,250	Manual	AG	0.80	2.4	60	GE
			1	63,600	Francis	240		190	MS	W	Plate st	Head gt	56,250	Manual	BG	0.80	13.8	60	WE
...	.....	480,000	3	120,000	Francis	150	.....	355	BL	.....	Welded pl st	Butterfly	100,000	Auto.or man.	AG	0.90	13.8	60	WE
....	.....	92,500	1	92,500	Francis	164	375-240	335	AC	.....	Welded pl st	Butterfly	66,700	Manual	BG	0.90	11.00	60	WE
....	.....	2,940	1	2,940	Propeller	180	30	30	MS	W	Concrete	Head gt	2,250	Manual	AG	0.80	2.4	60	EM
			8	111,300	Kaplan	87.5	92-65	80	MS	AC	Concrete	Head gt	73,684	Manual	BG	0.95	13.8	60	GE
....	.....	1,567,200	2	4,500	Francis	277	92-65	80	PW	W	Concrete	Head gt	3,750	Manual	BG	0.80	4.16	60	EM
....	.....	140,000	2	70,000	Francis	163.6	375-225	290	BL	W	Plate st	Butterfly	55,555	Manual	BG	0.90	13.8	60	WE
....	.....	26,500	1	26,500	Francis	163.6	98-73	91	BL	.....	Plate st	Head gt	20,000	Manual	BG	0.90	13.8	60	.....
....	.....	16,000	1	16,000	Francis	164	107	107	AC	W	Plate st	Head gt	12,941	Automatic	AG	0.85	6.9	60	GE
....	.....	25,000	1	25,000	Francis	200	169	169	AC	W	Plate st	Head gt	21,176	Automatic	AG	0.85	6.9	60	GE
....	.....	55,800	3	18,600	Francis	400	471	440	MS	W	Plate st	Butterfly	16,667	Manual	AG	0.85	6.9	60	AC
1	1949	20,000	1	10,000	Francis	225	89-80	88	MS	MS	Concrete	Head gt	9,375	Manual	AG	0.80	11.5	60	WE
			1	10,000	Francis	225	89-80	88	MS	W	Concrete	Head gt	9,375	Manual	AG	0.80	11.5	60	AC
....	.....	11,000	1	11,000	Kaplan	171.4	55	55	BL	W	Concrete	Head gt	9,412	Automatic	AG	0.85	11.5	60	GE
....	.....	1,100	1	1,100	Francis	200	23	23	JL	W	Concrete	Head gt	1,000	Manual	AG	0.75	2.4	60	GE
4	1944-48	518,500	4	103,000	Francis	150	480-234	330	AC	AC	Plate st	Head gt	75,000	Auto.or man.	AG	1.00	13.8	60	GE
.....	.....		2	3,500	Francis	600	480-234	330	JL	W	Cast steel	Head gt	2,500	Auto.or man.	AG	0.80	2.4	60	GE
1	1949		1	103,000	Francis	150	480-234	330	AC	AC	Plate st	Head gt	75,000	Auto.or man.	AG	1.00	13.8	60	GE

U. S. and Canadian Hydroelectric Plants Put

Company or government agency (Compiled by F A Annett, Associate Editor)	Design or consulting engineers	Project name	[1]New or redeveloped	River	State or Province	Project started, date	[2]Dam type	Crest length, ft	Max height, ft	Date of initial operation	Initial capacity, hp
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Keswick	New	Sacramento	Calif.	1941	CG	1,050	120	1949	102,000
U. S. Bureau of Reclamation	U. S. Corps of Engineers; U. S. Bureau of Reclamation	Folsom	New	American	Calif.	.....	C&E	12,000	340	1953	225,000
Pacific Gas & Electric Co	Pacific Gas & Elec Co	Rock Creek	New	N F Feather	Calif.	1947	CG	550	120	1950	147,000
Pacific Gas & Electric Co	Pacific Gas & Elec Co	Cresta	New	N F Feather	Calif.	1947	CG	367	103	1949	93,000
Pacific Gas & Electric Co	Pacific Gas & Elec Co	Colgate	Red.	N F Yuba	Calif.	1948	CG	175	41	1949	35,000
Southern California Edison Co	Stone & Webster Engr Corp; Southern Calif Edison Co	Big Creek No. 3	New	San Joaquin	Calif.	1921	CA	494	130	1923	105,000
Southern California Edison Co	International Engineering Co.; Bechtel Corp—Morrison-Knudsen Co.	Big Creek No. 4	New	San Joaquin	Calif.	1949	CG	945	228	1951	115,000
Imperial Irrigation District	U. S. Bureau of Reclamation	Drop No. 4	New	All Am. Canal	Calif.	1937	None	.....	....	1941	13,300
Dept of Water & Power, City of Los Angeles	F J Converse, Chas T Leeds; Chester Marlieve, C R Rankin & Dept's Power System Engrs	Owens Gorge No. 1; Owens Gorge No. 2; Owens Gorge No. 3	New	Owens	Calif.	1948	.....	.....	....	1950	153,600
Pasadena Water Dept	Morris S Jones	Azusa	Red.	San Gabriel	Calif.	1947	.....	.....	....	1949	3,400
ALASKA											
Alaska Electric Lt & Pwr Co	Alaska Elec Lt & Pr Engr Staff	Gold Creek	New	Gold Creek	Alaska	1906	CG	42	6	1907	1,200
CANADA					PROVINCE						
Newfoundland Lt & Pwr Co	Montreal Engineering Co	Mobile	New	Mobile	N.F.	1949	CG	250	5	1951	13,000
Avon River Power Co	Montreal Engineering Co	Methals	New	Methals	N.S.	1947	EF	1,000	50	1949	4,500
Avon River Power Co	Montreal Engineering Co	Black River Ext	New	Black	N.S.	1941	EF	750	80	1942	4,500
Avon River Power Co	Montreal Engineering Co	Paradise	New	Paradise	N.S.	1948	EF	750	17	1950	5,000
Nova Scotia Power Commission	K E Whitman	Deep Brook	New	Mersey	N.S.	1948	EF	2,600	45	1950	12,000
Northern Quebec Power Co	Power Corp of Canada	Quinze	New	Ottawa	Que.	1921	S&R	2,500	60	1923	20,000
Quebec Hydro-Elec Commission	.....	Beauharnois No. 1	New	St. Lawrence	Que.	1929	P&G	4,500	31	1932	440,000
Quebec Hydro-Elec Commission	H G Acres Co	Beauharnois No. 2	New	St. Lawrence	Que.	1948	P&G	4,500	31	1951	318,000
Quebec Hydro Elec Commission	Silas H Woodward	Rapid No. 7	New	Ottawa	Que.	1938	Earth	3,000	80	1941	48,000
Shawinigan Water & Power Co	Shawinigan Engineering Co	Shawinigan No. 3	New	St. Maurice	Que.	1946	CG	.....	....	1948	195,000
Shawinigan Water & Power Co	Shawinigan Engineering Co	Trenche	New	St. Maurice	Que.	1948	CG	.....	....	1950	325,000
Gatineau Power Co	.....	Bryson	New	Ottawa	Que.	.....	.....	.....	....	.....	54,000
Electrique de Mont Laurier	.....	.....	New	Lievre	Que.	1948	.....	.....	....	1950	2,650
Town of Jonquire	.....	.....	New	.....	Que.	1947	.....	.....	....	1949	4,200
Ogilvie Flour Mills	R A Rankine Co	Royal Mill	New	St. Lawrence	Que.	1948	.....	.....	....	1949	3,200
City of Riviere du Loup	Roland & S P Beaulieu	.....	New	Riviere du Loup	Que.	1947	.....	.....	96	1949	1,800
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Le Cave	New	Ottawa	Ont.& Que.	1948	CSB	2,500	130	1952	198,000
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont.	Des Joachims	New	Ottawa	Ont.	1947	CG	5,500	165	1950	496,000
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont.	Tunnel	New	Mississagi	Ont.	1947	CG	950	230	1949	58,000
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont.	Pine Portage	New	Nipigon	Ont.	1947	CG	3,000	150	1950	82,000
Hydro-Elec Power Comm of Ont	H G Acres Co	Chenaux	New	Ottawa	Ont. & Que.	1948	CG	4,000	70	1950	168,000
Gananoque Elec Lt & Water Co	H G Acres Co	Jones Falls	New	Rideau Canal	Ont.	1946	.....	.....	....	1948	1,380
Abitibi Power & Paper Co	H G Acres Co	Iroquois Falls	Red.	Abitibi	Ont.	1948	.....	.....	....	1949	12,500
Orillia Water Lt & Pr Comm	L G McNeice	Matthias	New	South	Ont.	1949	CG	792	35	1951	3,700
Pembroke Electric Co	H G Acres Co	Waltham	Red.	Black	Que.	1940	CBS	250	30	1941	2,200
Great Lakes Power Co	Harza Engineering Co	High Falls	New	Michipicoten	Ont.	1949	CG	190	30	1950	23,300
Eagarville Lt & Pr Comm	.....	.....	New	.....	Ont.	.....	.....	.....	....	.....	320
Bancroft Municipal	.....	.....	New	.....	Ont.	.....	.....	.....	....	.....	185
Winnipeg Electric Co	Power Corp of Canada; Winnipeg Elec Co Engrg Staff	Seven Sisters	New	Winnipeg	Man.	1929	CG	620	80	1931	112,500
Manitoba Dept of Mines & Res	H G Acres Co; Dr T H Hogg	Pine Falls	New	Winnipeg	Man.	1948	CG	910	65	1951	114,000
Calgary Power Co	Montreal Engineering Co	Spray	New	Spray	Alta.	1948	REF	625	190	1950	62,000
Calgary Power Co	Montreal Engineering Co	Three Sisters	New	Goat Creek	Alta.	1948	EF	2,000	50	1950	4,700
Calgary Power Co	Montreal Engineering Co	Kananaskis Ext	New	Bow	Alta.	1950	.....	.....	....	1951	9,000
Calgary Power Co	Montreal Engineering Co	Rundle	New	Bow	Alta.	1950	.....	.....	....	1951	23,000
Bridge River Power Co	Shawinigan Engrg Co; B C Elec Co Engr Staff	Bridge River	New	Bridge	B.C.	1946	EF	1,000	60	1948	186,000
British Columbia Electric Co	British Columbia Elec Co	Lake Buntzen No. 1.	Red.	Coquitlam	B.C.	1950	CG	250	42	1951	70,000
British Columbia Power Corp	British Columbia Pwr Corp.	Ruskin	New	Stave	B.C.	1929	.....	.....	....	1930	47,000
Consolidated Mining & Smelting Co	.....	Brilliant	New	Kootenay	B.C.	1942	CG	.....	140	1944	74,000
British Columbia Power Comm	H G Acres Co	John Hart	New	Cambell	B.C.	1945	CG	2,900	140	1948	56,000
British Columbia Power Comm	B C Power Comm Staff; H G Acres Co	Whatshan	New	Watshan	B.C.	1948	CG	.....	.....	1950	33,000
British Columbia Power Comm	.....	Clowham Falls	New	.....	B.C.	1950	.....	.....	....	.....	4,000
British Columbia Pulp & Paper Co	.....	Flume House	New	.....	B.C.	1948	.....	.....	....	1949	1,200
City of Nelson	A C R Yull	Municipal Hydro Pl.	New	Kootnay	B.C.	1947	CG	250	33	1949	6,700
City of Revelstoke	.....	.....	New	.....	B.C.	1948	.....	.....	....	1949	.....

U. S. and Canada Hydro Table

[1]The term "New" applies to an entirely new project on a site that has not been developed before. "Redeveloped" indicates a project on a site that has been developed before and now has new wheels, generators and settings or a new plant.

[2]CG, concrete gravity; CA, concrete arch; C&E, concrete and earth; EF, earth fill; MA, multiple arch; R&E, rock and earth fill; HEF, hydraulic earth fill; P&G, piers and gates; CGE, concrete gravity and earth fill; CGG, concrete gravity with gates; S&R, sluice-ways and rock fill; RE, rolled earth; CBS, concrete buttresses and steplog sluices; RF&C, rock fill and concrete gravity; LC, log crib.

[3]AC – Allis-Chalmers Mfg Co
CAC – Canadian Allis-Chalmers, Ltd
CBS – Charles Barber & Sons
CVL – Canadian Vickers, Ltd
DEW – Dominion Engineering Works, Ltd
JIC – John Inglis Co
JL – James Leffel & Co

in Operation or Under Construction in 1949-50

Added cap. No. of units	Date of added cap.	Ultimate capacity, hp	No. of units installed	Waterwheel capacity, hp	Waterwheel type	Speed, rpm	Static head, ft	Design head, ft	*Waterwheel manufacturer	†Governor manufacturer	Scroll case, concrete or steel	Penstock valve, type	Generator capacity, kva	Synchronizing cabinet or panel	‡Thrust-bearing location	Design power factor	Kilovolts	Cycles	§Generator manufacturer
....	.....	102,000	3	34,000	Francis	94.7	102-46	90	MS	W	Concrete	Head gt	25,000	Auto.or man.	AG	1.00	3.8	60	GE
....	.....	225,000	3	75,000	Francis	.....	.....	.....	.....	.....	.....	.....	.....	Manual	AG	.....	.....	...	.....
....	.....	147,000	2	73,500	Francis	240	535	481	NN	W	Plate st	Butterfly	63,000	Auto.or man.	AG	0.90	13.8	60	WE
....	.....	93,000	2	46,500	Francis	180	290	254	PW	W	Plate st	Butterfly	37,000	Auto.or man.	AG	0.90	11.5	60	GE
....	.....	35,000	1	35,000	Francis	450	852	728	PW	W	Plate st	Butterfly	30,000	Auto.or man.	AG	0.90	11.5	60	WE
1	1949	177,000	{3 1	[3]44,000 45,000	Francis Francis	428 450	830 830	760 760	PW PW	W W	Cast st Cast st	Butterfly Butterfly	33,000 35,000	Manual Manual	AG AG	0.80 0.80	11.0 12.5	60 60	WE WE
....	.....	115,000	2	57,500	Francis	257	420-362	383	PW	W	Welded pl st	Butterfly	42,000	Auto.or man.	AG	1.00	11.5	60	{1 AC 1 GE
1	1949	28,300	{1 1	13,300 15,000	Propeller Kaplan	150 138.5	56-49 56-49	51 51	NN AC	W W	Concrete Concrete	Head gt Head gt	12,000 12,500	Manual Manual	AG AG	0.80 0.80	6.9 6.9	60 60	EC GE
....	.....	153,600	{1 1 1	51,200 51,200 51,200	Francis Francis Francis	400 400 400	820 790 790	743 743 743	PW PW PW	W W W	Cast st Cast st Cast st	Plug Plug Plug	37,500 37,500 37,500	Automatic Automatic Automatic	AG AG AG	1.00 1.00 1.00	11.5 11.5 11.5	60 60 60	WE WE WE
....	.....	3,400	1	3,400	Francis	720	.....	395	JL	W	Plate st	Head gt	3,000	Automatic	AG	1.00	2.4	60	AC
1	1950	2,400	{2 1	600 1,200	Impulse V Impulse	360 277	225 225	210 214	PW PW	.....	....	Gate Gate	500 1,000	Manual Manual	HS AG	0.80 0.80	2.3 2.3	60 60	WE GE
....	.....	13,000	1	13,000	Francis	514	380-369	370	DEW	W	Welded pl st	Butterfly	11,000	Auto.or man.	AG	0.85	6.9	60	CWC
....	.....	4,600	1	4,600	Propeller	240	51-48	45	DEW	W	Concrete	Head gt	4,000	Automatic	AG	0.85	6.9	60	CWC
1	1949	9,000	{1 1	4,500 4,500	Francis Francis	257 450	203 203	185 185	DEW DEW	DEW W	Plate st Plate st	Butterfly Butterfly	3,500 4,200	Manual Manual	AG AG	0.80 0.85	6.9 6.9	60 60	CWC CWC
....	.....	5,000	1	5,000	Francis	720	506	476	CVL	CVL	Cast st	Gate valve	4,500	Manual	AG	0.80	6.9	60	CWC
....	.....	12,000	2	6,000	Kaplan	200	46	46	MSC	W	Concrete	Head gt	5,000	Automatic	AG	0.80	6.9	60	CWC
{2 {1	1928 1950	119,000	{2 1	10,000 10,000 35,000	Francis Francis Francis	187 187 107	70-90 70-90 70-90	70 70 90	DEW DEW CAC	.... W	Plate st Plate st Welded pl st	Head gt Head gt Head gt	10,000 10,000 32,500	Manual Manual Manual	AG AG AG	0.80 0.80 0.80	11.0 11.0 11.0	25 25 25	SEC SEC CGE
6	1939-48	2,136,000	{4 2 10 3 3	53,000 8,000 53,000 53,000 53,000	Francis Francis Francis Francis Francis	75 180 75 75 75	82-75 82-75 82-75 82-75 82-75	80 80 80 80 80	DEW DEW DEW DEW CAC	DEW DEW DEW W W	Concrete Concrete Concrete Concrete Concrete	Head gt Head gt Head gt Head gt Head gt	43,886 7,200 46,625 51,000 51,000	Manual Manual Manual Automatic Automatic	BG AC BG AG AG	0.85 0.90 0.90 0.80 0.80	13.2 13.2 13.2 13.8 13.8	1 OC, 3 CGE 60 60 60 60	CGE CGE CWC CGE
1	1949	64,000	4	16,000	Francis	115.4	71-52	68	DEW	W	Plate st	Head gt	15,000	Manual	AG	0.80	13.8	25	CWC
1	1949	195,000	{2 1	65,000 65,000	Francis Francis	120 120	150-130 150-130	145 145	DEW DEW	W W	Plate st Plate st	Head gt Head gt	62,500 62,500	Auto.or man. Auto.or man.	AG AG	0.80 0.80	13.8 13.8	60 60	CGE CGE
....	.....	390,000	5	65,000	Francis	128.6	160	160	DEW	W	Plate st	Head gt	53,000	Automatic	AG	0.90	13.8	60	CGE
1	1949	81,000	{2 1	27,000 27,000	Francis Francis	120 120	60 60	60 60	DEW DEW	W W	Plate st Plate st	Head gt Head gt	25,000 25,000	Manual Manual	AG AG	0.80 0.80	6.9 6.9	60 60	CGE CGE
....	.....	.....	2	1,325	Propeller	180	22	22	DEW	.....	Concrete	Head gt	1,000	Manual	AG	0.80	6.9	60	CGE
....	.....	4,200	1	4,200	Kaplan	257	47	47	MSC	W	Concrete	Head gt	3,125	Manual	AG	0.80	2.75	60	CGE
....	.....	3,200	2	1,600	Propeller	180	24	24	DEW	W	Concrete	Head gt	1,425	Manual	AG	0.80	2.3	60	CGE
....	.....	1,800	1	1,800	Francis	400	96	96	MSC	W	Plate st	Head gt	1,500	Manual	AG	0.80	2.4	60	CGE
....	.....	264,000	{4 2	33,000 33,000	Francis Francis	94.7 94.7	82-72 82-72	77 77	CAC JIC	W W	Concrete Concrete	Head gt Head gt	27,000 27,000	Automatic Automatic	BG BG	0.95 0.95	13.8 13.8	60 60	CWC CWC
....	.....	496,000	8	62,000	Francis	105-9	135-124	130	DEW	W	Plate st	Head gt	50,000	Manual	AG	0.90	13.8	60	CWC
....	.....	58,000	2	29,000	Francis	211.8	219-214	200	CAC	W	Plate st	Head gt	23,500	Manual	AG	0.90	13.8	60	CWC
....	.....	164,000	2	41,000	Francis	109.1	110-100	105	CAC	W	Plate st	Head gt	33,000	Manual	AG	0.90	13.8	60	CWC
....	.....	168,000	8	21,000	Propeller	94.7	41-25	40	DEW	W	Concrete	Head gt	17,000	Manual	AG	0.90	13.8	60	CGE
1	1949	3,640	{1 1 1	1,130 1,130 250	Francis Francis Francis	514 514	62-56 62-56 62-56	58 58 58	CBS CBS CBS	W W W	Plate st Plate st Plate st	Head gt Head gt Head gt	1,000 1,000 235	Manual Manual Manual	HS HS HS	0.80 0.80 0.80	2.3 2.3 2.3	60 60 60	CGE CGE CGE
....	.....	26,700	5	2,500	Francis	240	46-26	42.5	MSC	W	Open flume	Head gt	2,250	Manual	HS	0.90	12.5	60	CWC
{1	1945	3,700	1	3,700	Kaplan	257	42	42	MSC	W	Concrete	Head gt	3,125	Auto.or man.	AG	0.85	4.0	60	CGE
{1	1950	12,500	{1 1	2,200 2,500 3,000	Francis Francis Francis	514 360 460	132-125 132-125 132-125	125 125 125	JL MSC CVL	W W W	Cast st Plate st Plate st	Steel cone Steel cone Butterfly	1,800 2,250 2,812	Manual Manual Manual	HS HS AG	0.85 0.85 0.80	2.5 2.5 2.5	60 60 60	CWC CWC CWC
....	.....	36,500	1	13,200	Francis	240	150-147	147	MSC	W	Plate st	Head gt	10,750	Manual	AG	0.90	11.0	60	CGE
1	1949	480	{2 1 1	160 160 185	Francis Francis Francis	257 257 257	19 19 21	19 19 21	CBS CBS CBS	W W W	Concrete Concrete Concrete	Head gt Head gt Head gt	 156	.... Manual	.... HS	.... 0.80	.... 2.3	 60	CGE CGE EEC
1	1949	375	1	185	Francis	257	21	21	CBS	W	Concrete	Head gt	156	Manual	HS	0.80	2.3	60	EEC
2	1949-50	225,000	{3 2	37,500 37,500	Propeller Propeller	128.6 128.6	66 66	66 66	{1 AC, 1 DEW 1 MS 3 W DEW	W	Concrete	Head gt	32,500	Manual	AG	0.85	11.0	60	CGE
....	.....	114,000	6	19,000	Propeller	94.7	37	37	DEW	W	Concrete	Head gt	15,500	Auto.or man.	AG	0.90	13.8	60	CGE
....	.....	62,000	1	62,000	Francis	450	910	900	DEW	W	Cast st	Spherical	55,000	Automatic	BG	0.85	13.2	60	CWC
....	.....	4,700	1	4,700	Propeller	277	62-30	50	DEW	W	Welded pl st	Butterfly	4,000	Automatic	BG	0.85	6.9	60	CWC
....	.....	21,000	1	12,000	Francis	225	72	72	DEW	W	Welded pl st	Head gt	11,500	Auto.or man.	AG	0.85	13.2	60	CWC
....	.....	23,000	1	23,000	Francis	300	318	318	DEW	W	Welded pl st	Head gt	20,000	Auto.or man.	AG	0.85	13.2	60	CWC
2	1949	620,000	{1 2	62,000 62,000	Impulse Impulse	300 300	.....	1,130 1,130	{PW VEW	W W	....	Spherical Spherical	50,000 50,000	Manual Manual	AG AG	0.90 0.90	13.8 13.8	60 60	CWC CWC
....	.....	70,000	2	70,000	Francis	240	410-390	380	PW, VEW	PW	Plate st	Butterfly	62,500	Automatic	BG	0.80	13.8	60	CWC
{1 {1	1938 1950	188,000	{2 1	47,000 47,000	Francis Francis	120 120	130 130	123 123	DEW DEW	W W	Plate st Plate st	Head gt Head gt	44,000 44,000	Manual Manual	BG BG	0.80 0.80	13.2 13.2	60 60	CWC CWC
1	1950	148,000	{2 1	37,000 37,000	Francis Francis	100 100	100 100	90 90	DEW DEW	W W	Plate st Plate st	Head gt Head gt	32,000 32,000	Manual Manual	AG AG	0.85 0.85	13.2 13.2	60 60	CWC CWC
2	1949	166,000	{2 2	28,000 28,000	Francis Francis	327.3 327.3	480-394 480-394	390 390	DEW DEW	W W	Plate st Plate st	Butterfly Butterfly	25,000 25,000	Manual Manual	AG AG	0.80 0.80	13.8 13.8	60 60	CWC CWC
....	.....	66,000	2	16,500	Francis	600	715-667	690	CAC	W	Welded pl st	Butterfly	12,500	Manual	AG	0.90	6.9	60	CGE
....	.....	4,000	2	2,000	Francis	.....	.....	.....	VEW	W	.....	Butterfly	1,875	.....	....	.....	.....	60	BCL
....	.....	1,200	1	1,200	Francis	900	.....	365	CAC	W	.....	.....	.....	.....	....	.....	.....	....	CGE
....	.....	13,500	1	6,750	Francis	164	70	70	CAC	W	Plate st	Head gt	6,000	Manual	AG	0.80	12.00	60	CGE
....	.....	.....	1	.....	.....	360	.....	.....	.....	.....	.....	.....	1,125	Manual	HS	0.8	4.15	60	CWC

MS – S Morgan Smith Co
MSC – S Morgan Smith, Canada, Ltd
NN – Newport News Shipbuilding & Dry Dock Co
PW – Pelton Water Wheel Co
VEW – Vancouver Engineering Works, Ltd
W – Woodward Governor Co
BCL – Bepco Canada, Ltd

CGE – Canadian General Electric Co, Ltd
CWC – Canadian Westinghouse Co, Ltd
EC – Elliott Co
EEC – English Electric Co of Canada, Ltd
GE – General Electric Co
QC – Dartikan, Canada, Ltd
SEC – Swedish Electric Co, Ltd

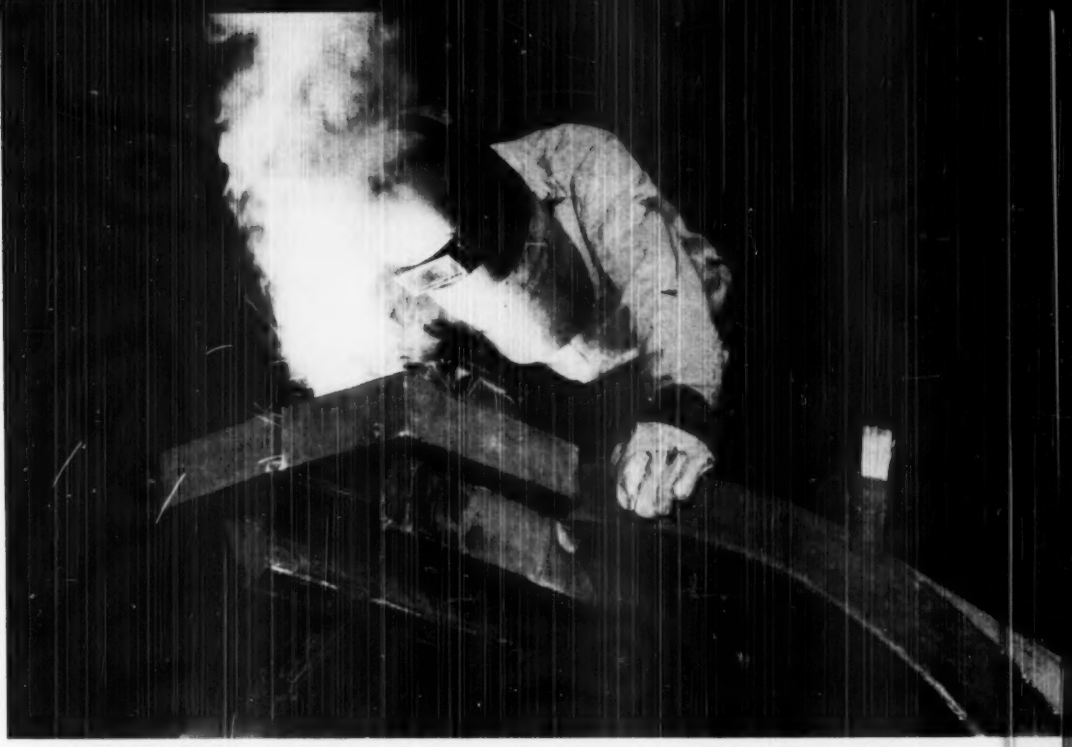
SGE – Swedish General Electric Co, Ltd
WE – Westinghouse Electric Corp

*AG – indicates that the thrust bearing is above the generator; BG, thrust bearing is below the generator; HS, horizontal-shaft machine.
†Units installed in 1923, rated 35,000 hp, have been rebuilt for 44,000 hp.

Government-Agency Hydroelectric Projects

(Does not include municipal plants)

Government agency	Project	State	River	Ultimate capacity, hp	Initial capacity, hp	Installed capacity, hp	On order or being installed, hp
U. S. Bureau of Reclamation	Grand Coulee	Wash.	Columbia	3,012,000	523,000	2,517,000	495,000
	Hungry Horse	Mont.	S F Flathead	420,000	420,000	.....	420,000
U. S. Corps of Engineers	Bonneville	Ore. & Wash.	Columbia	729,000	137,000	729,000	.....
	Big Cliff	Ore.	North Santiam	26,500	26,500	.....	26,500
	Detroit	Ore.	North Santiam	140,000	140,000	.....	140,000
	Chief Joseph	Wash.	Columbia	2,700,000	1,000,000	.....	1,000,000
	McNary Dam	Ore. & Wash.	Columbia	1,558,200	890,400	.....	890,400
U. S. Bureau of Reclamation	Anderson Ranch	Idaho	Boise	55,500	37,000	37,000	.....
	Minidoka	Idaho	Snake	26,500	9,000	19,500	.....
	Shasta	Calif.	Sacramento	522,000	419,000	522,000	.....
	Keswick	Calif.	Sacramento	102,000	102,000	102,000	.....
	Folsom	Calif.	American	225,000	225,000	.....	.....
Imperial Irrigation District	Drop No. 3	Calif.	All Am. Canal	15,000	7,500	7,500	.....
	Drop No. 4	Calif.	All Am. Canal	28,300	13,300	28,300	.....
U. S. Bureau of Reclamation	Parker Dam	Ariz. & Calif.	Colorado	160,000	120,000	160,000	.....
	Davis Dam	Ariz. & Calif.	Colorado	312,500	312,500	312,500	.....
	Hoover Dam	Ariz. & Nev.	Colorado	1,857,000	522,000	1,442,000	300,000
	Elephant Butte	N. M.	Rio Grande	34,500	34,500	34,500	.....
	Green Mountain	Colo.	Blue	30,000	30,000	30,000	.....
	Estes Park	Colo.	Colo. Big Thompson	63,000	63,000	63,000	.....
	Mary's Lake	Colo.	Colo. Big Thompson	11,300	11,300	11,300	.....
	Pole Hill	Colo.	Colo. Big Thompson	47,500	47,500	.....	.....
	Flatiron	Colo.	Colo. Big Thompson	96,000	48,000	.....	.....
	Kortes	Wyo.	North Platte	55,500	55,500	55,500	.....
	Shoshone	Wyo.	Shoshone	20,000	20,000	20,000	.....
	Heart Mountain	Wyo.	Shoshone	8,300	8,300	8,300	.....
	Boysen	Wyo.	Big Horn	21,000	21,000	21,000	.....
	Seminoe	Wyo.	North Platte	45,000	45,000	45,000	.....
	Canyon Ferry	Mont.	Missouri	70,500	70,500	.....	70,500
U. S. Corps of Engineers	Fort Peck	Mont.	Missouri	150,000	70,000	120,000	.....
Platte Valley Pub Pr & Irr Dist	Sutherland	Neb.	North Platte	35,000	35,000	35,000	.....
Consumer Public Power Dist	Spencer	Neb.	Niobrara	3,740	1,540	3,740	.....
Loup River Public Power Dist	Monroe	Neb.	Loup	9,600	9,600	9,600	.....
	Columbus	Neb.	Loup	54,000	54,000	54,000	.....
Central Neb. Pub Pr & Irr Dist	Jeffery Canyon	Neb.	Platte	26,000	26,000	26,000	.....
	Johnson No. 1	Neb.	Platte	26,000	26,000	26,000	.....
	Johnson No. 2	Neb.	Platte	50,000	25,000	25,000	.....
U. S. Corps of Engineers	Fort Randall	S. D.	Missouri	460,000	230,000	.....	230,000
	Garrison	N. D.	Missouri	440,000	176,000	.....	176,000
	St. Mary's Falls	Mich.	St. Mary's	72,750	23,925	.....	23,925
	Norfolk	Ark.	North Fork	168,000	42,540	84,540	.....
	Blakely Mountain	Ark.	Ouachita	106,000	106,000	.....	.....
	Bull Shoals	Ark.	White	211,000	159,000	.....	159,000
	Narrows	Ark.	Little Missouri	36,000	24,000	24,000	.....
Grand River Dam Authority	Pensacola Dam	Okla.	Grand	120,750	80,750	100,000	20,000
U. S. Corps of Engineers	Fort Gibson	Okla.	Grand	96,000	64,000	.....	64,000
	Tenkill Ferry	Okla.	Illinois	47,000	47,000	.....	47,000
	Dennison Dam	Okla. & Texas	Red	282,080	56,080	114,080	.....
Lower Colorado River Authority	Buchanan Dam	Texas	Colorado	51,900	34,600	51,900	.....
	Tom Miller	Texas	Colorado	20,000	20,000	20,000	.....
	Inks Dam	Texas	Colorado	16,000	16,000	16,000	.....
	Marshall Ford	Texas	Colorado	90,000	90,000	90,000	.....
	Granite Shoals	Texas	Colorado	66,000	66,000	.....	66,000
	Marble Falls	Texas	Colorado	42,000	42,000	.....	42,000
Brazos Riv Conser & Reclam Dist	Possum Kingdom	Texas	Brazos	51,000	34,000	34,000	.....
U. S. Corps of Engineers	Whitney Dam	Texas	Brazos	41,400	41,400	.....	41,400
	Wolf Creek	Ky.	Cumberland	377,000	377,000	.....	377,000
Tennessee Valley Authority	Kentucky	Ky.	Tennessee	220,000	176,000	220,000	.....
	Pickwick	Tenn.	Tennessee	302,000	96,000	192,000	110,000
	Wilson	Ala.	Tennessee	610,000	206,000	610,000	.....
	Wheeler	Ala.	Tennessee	360,000	90,000	360,000	.....
	Guntersville	Ala.	Tennessee	141,000	102,000	102,000	39,000
	Hales Bar	Tenn.	Tennessee	140,000	72,000	72,000	68,000
	Chickamauga	Tenn.	Tennessee	144,000	108,000	108,000	36,000
	Watts Bar	Tenn.	Tennessee	210,000	126,000	210,000	.....
	Norris	Tenn.	Clinch	132,000	132,000	132,000	.....
	Fort Loudoun	Tenn.	Tennessee	176,000	88,000	176,000	.....
	Cherokee	Tenn.	Holston	166,000	83,000	83,000	.....
	Douglas	Tenn.	French Broad	166,000	83,000	118,500	.....
	South Holston	Tenn.	South Holston	49,500	49,500	49,500	.....
	Watauga	Tenn.	Watauga	69,000	69,000	69,000	.....
	Fontana	N. C.	Little Tennessee	274,000	183,000	183,000	.....
	Apalachia	Tenn.	Hiwassee	106,000	106,000	106,000	.....
	Hiwassee	N. C.	Hiwassee	160,000	80,000	80,000	.....
	Chatuge	N. C.	Hiwassee	10,700	10,700	.....	.....
	Nottely	Ga.	Nottely	13,400	13,400	.....	.....
	Ocoee No. 3	Tenn.	Ocoee No. 3	33,500	33,500	33,500	.....
	Wilbur Dam	Tenn.		9,700	9,700	9,700	.....
U. S. Corps of Engineers	Buggs Island	Va. & N. C.	Roanoke	325,000	172,000	.....	172,000
	Philpott	Va.	Smith	19,640	19,640	.....	19,640
	Central Hill	Tenn.	Carney Fork	189,525	189,525	.....	189,525
	Dale Hollow	Tenn.	Obey	75,000	50,000	50,000	25,000
	Allatoona	Ga.	Etowah	152,900	102,900	102,900	.....
	Buford	Ga.	Chattahoochee	118,400	118,400	.....	.....
	JimWoodruff	Fla.	Chattahoochee	42,000	42,000	.....	42,000
	Clark Hill	Ga. & S. C.	Savannah	385,000	220,000	.....	220,000
S. Carolina Public Service Auth.	Santee-Cooper	S. C.	Santee	215,720	173,000	175,720	.....
	Santee-Spillway	S. C.	Santee	2,720	2,720	2,720	.....
Greenwood County Board of Comm	Buzzards	S. C.	Saluda	30,000	22,200	22,200	.....
Total Capacity				20,588,525	10,363,020	10,264,280	5,409,890



METAL-ARC WELDING gives a pressure-tight seam for 4½-in. alloy steel boiler drum for 950 psi, 1000-F service

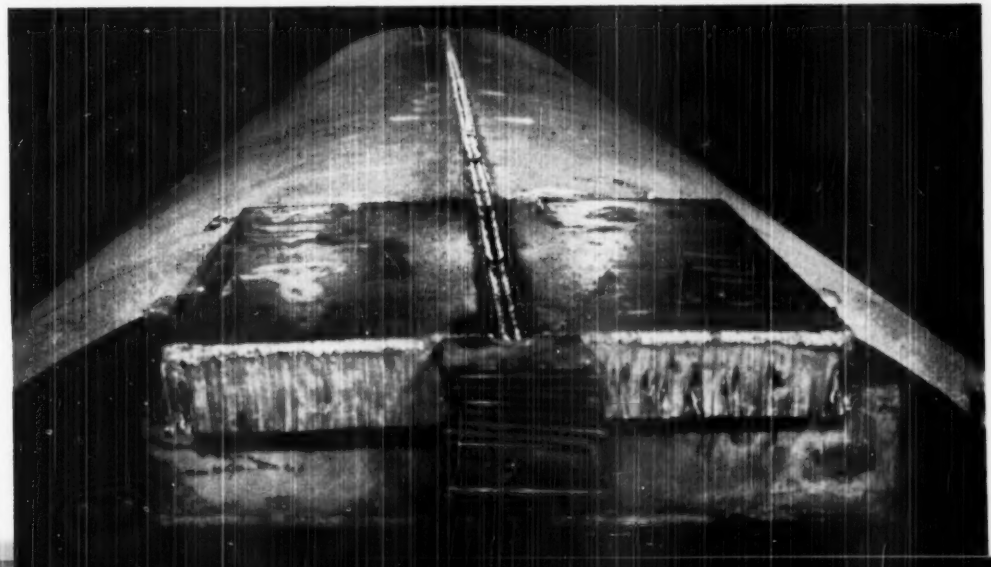
Arc Welding: Maintenance Tool

► THREE MAJOR ELECTRIC arc-welding processes, namely the metal-arc, atomic-hydrogen, inert-arc methods, make it possible to join almost any metals (see table p 112) with excellent bonding at low cost. Metal-arc and inert-arc use either ac or dc as a welding current. Atomic-hydrogen requires ac only.

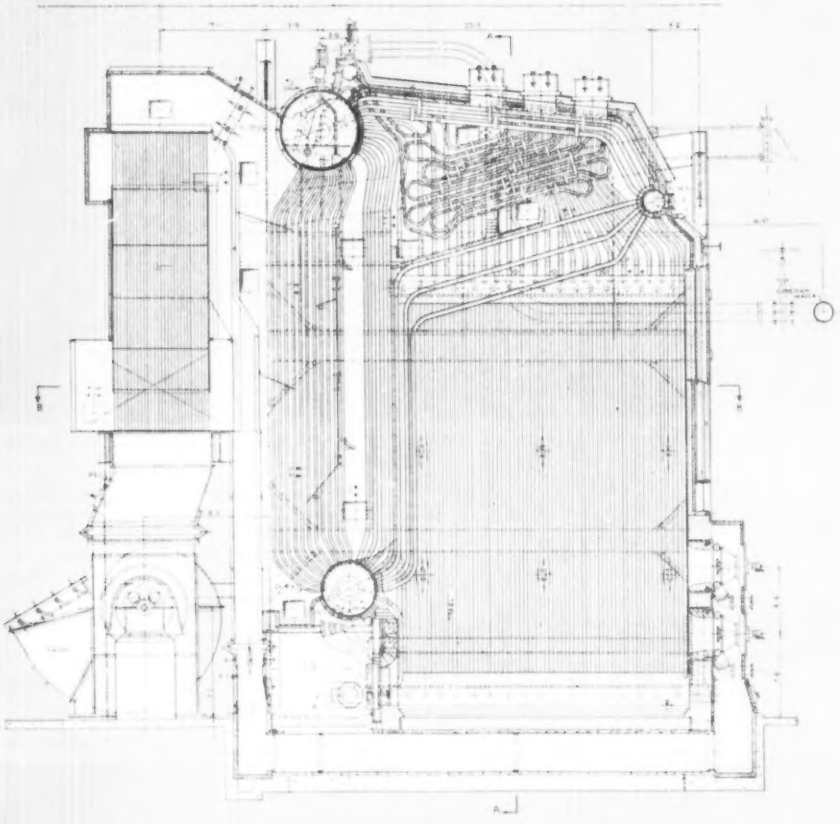
Metal-arc work, photo above, has these advantages over other welding methods: speed, flexibility, low operating and investment costs. It works best where considerable filler

MORE WELDING DATA ON PAGE 112

TEST PLATE at end of welded groove, welded in same way as drum, allows running tests without damage to drum itself



Add 5 more RILEY units



Cross Section of the ten 300,000 lbs./hr. Riley gas and oil fired Steam Generating Units of this large chemical plant. These units operate at 500 psig and 750°F. In addition to these ten Riley Units, there are four 450,000 lbs./hr. Riley Units operating at 1425 psig and 900°F.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

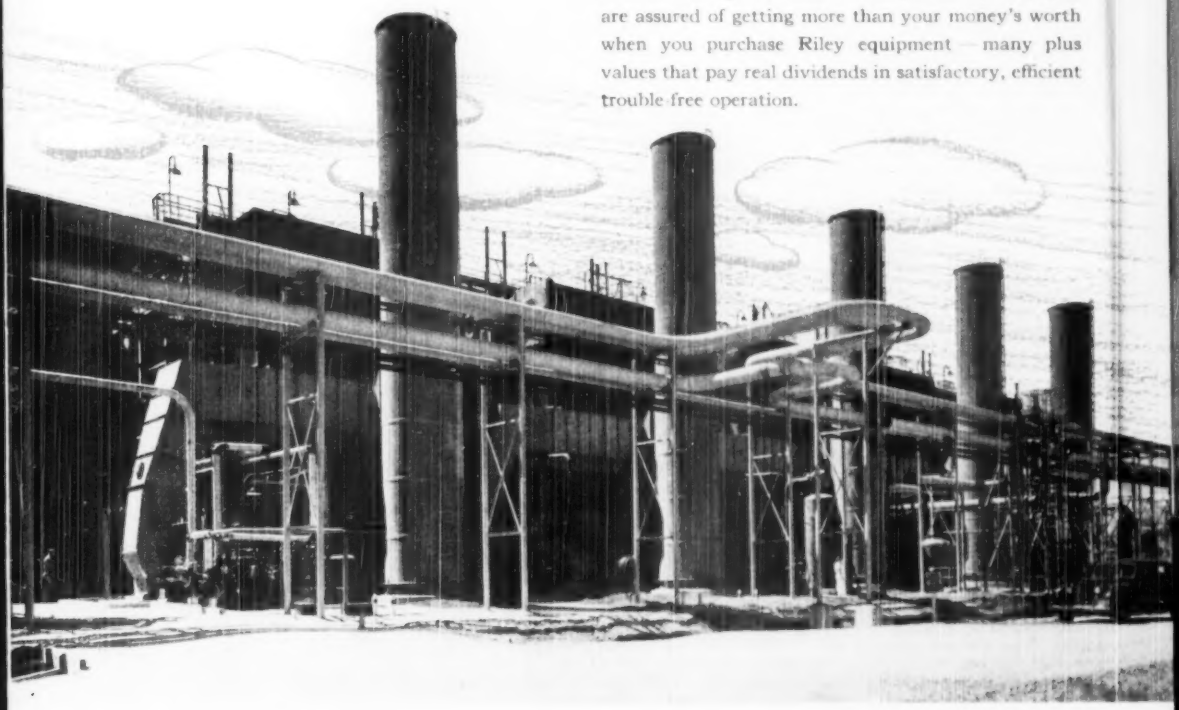
BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

...making a total of 10

This will be the South's largest industrial power plant

The first three Riley Units at this large outstanding chemical plant were installed in 1940. Two additional units were installed in 1941, another two in 1946, one more in 1950 and the ninth and tenth units will be installed in 1951. In addition to these ten Riley Units, two more units having a capacity of 450,000 lbs. /hr. and operating at 1425 psig—900°F. steam, will be added to the existing two units of this size. These 14 units with a total capacity of 4,800,000 lbs. /hr. will make this one of the largest industrial power plants in the south. This company has placed 10 orders with Riley for 18 boiler units.

What better assurance can be provided that you can rely on Riley, than the fact that users invariably come back for more Riley Units when additional capacity is required. Throughout the country, Riley Steam Generating Units are giving such a good account of themselves that when additional units are required in many cases Riley Units are purchased without competition. Because of the regularity with which Riley Units exceed guaranteed efficiency and capacity, you are assured of getting more than your money's worth when you purchase Riley equipment — many plus values that pay real dividends in satisfactory, efficient trouble-free operation.

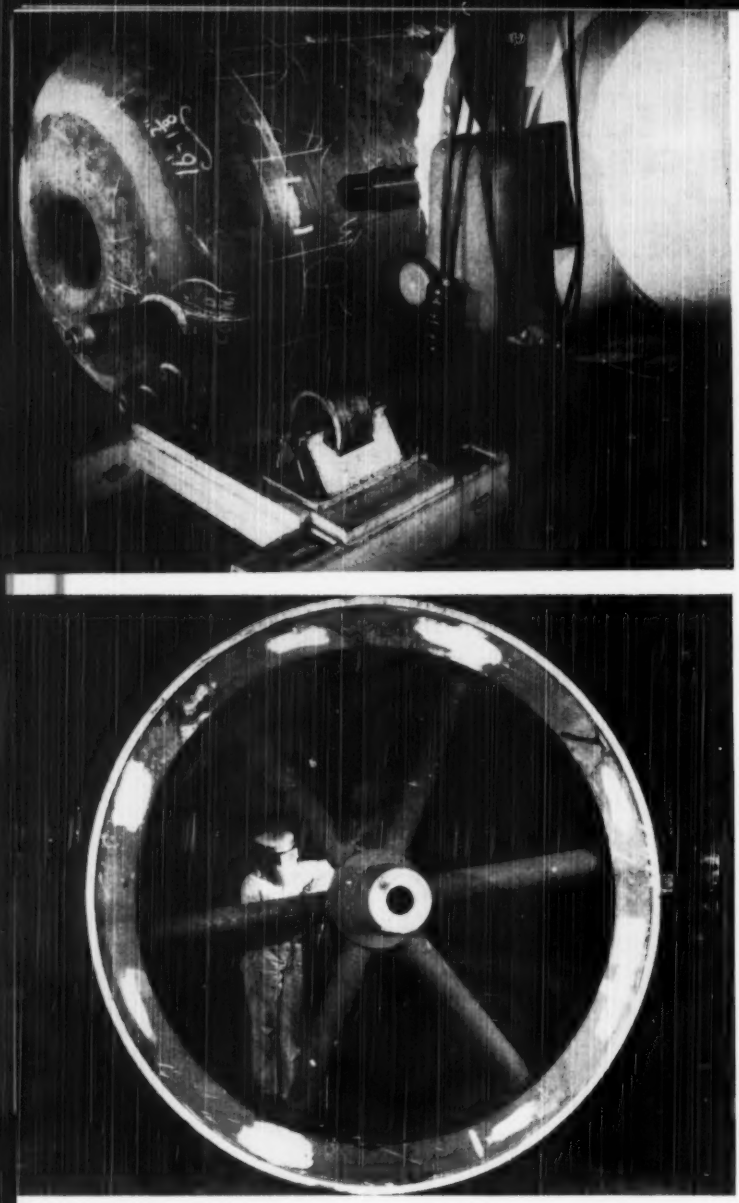


A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS



X-RAY MACHINE is required to run tests on the finished weld between dished head and drum plates. It is the only way of seeing all through the 4½-in.-deep weld. **DRYER ROLL,** like the above, is now of welded-steel construction. It weighs 23% less than the cast-iron model it replaced. It is stronger and tougher in service.

metal must be added to complete a joint. Deep-groove welds or fillet welds are examples of its field.

Atomic-hydrogen welding copes with the hard-to-weld metals, thin sheets and other special problems ordinary welding methods do not solve. Here the arc is struck and sustained between two electrodes, entirely independent of the work. The hydrogen goes through a change from molecular form to atomic and back again with a rapid heat transfer to the work.

Inert-arc welding is the answer to light-metal problems. The welds are free from oxidation, pin holes, weld spatter. A shield of inert gas surrounds the arc. Slow-moving argon or helium issues from the nozzles of a special electrode.

TYPICAL METALS YOU CAN ARC-WELD

READILY WELDABLE

Aluminum alloys

Galvanized steel

Gold

Lead (as in storage batteries, chemical tanks)

Lead-coated steel (such as "terne-plate" for tanks)

Low-carbon steel (below .25% C as used in most structural work)

Manganese-vanadium steel (high-strength structures such as high-pressure boilers)

Nickel alloys—monel, inconel, nickel

Silver (as used for linings in chemical vats)

Stainless steel (chrome nickel)

Tin plate (such as is used in food industries)

WELDABLE

Carbon-moly cast steel (for high-temperature steam applications)

Chrome-moly steel (aircraft tubing)

Copper alloys—silicon bronze, deoxidized copper, brass, etc.

Hardfacing, such as stellite, high-carbon steel

Ingot iron .02-.04% C (used where material is to be enameled)

Magnesium alloys

Medium-carbon steel .30-.40% C (used for shafting and high-strength castings)

Molybdenum (as used for heating elements in furnaces)

3½% nickel steels

Stainless steel (straight chrome)

Tungsten (as used for spark-plug electrodes)

DIFFICULT

Cast iron—white, gray, malleable

High-carbon steel .50%-.80% C (used in tools, etc)

Now better than ever

NEW

STANOIL Industrial Oils

Brings two new benefits to wide range of jobs

For years, STANOIL Industrial Oils have proved their ability to handle a wide variety of jobs in midwest plants. Now, these established products have been made better than ever. They offer these new and important savings to a wider variety of industrial equipment.

SPEED REDUCER

HEAD STOCK GEARS

HYDRAULIC SYSTEM

AUXILIARY TURBINE

COMPRESSOR

MOTORS

1 LONGER OIL LIFE

They have greater oxidation stability. The new STANOILs stand up under high temperatures operation. Many machines last longer because of equipment with fewer deposit systems free from deposits caused by oil oxidation.

2 GREATER PROTECTION against RUST

A corrosion inhibitor of the most advanced type has been added to all grades of the new STANOILs that benefit by such an additive. This inhibitor prevents corrosion trouble by "plating out" on surfaces that tend to rust. In such severe service as paper-machine and steam-turbine lubrication, new STANOILs have put an end to rust and corrosion troubles.

At the left are shown several types of equipment in which the new STANOILs can save you money and maintenance time. A Standard Oil Lubrication Engineer will help you find still other applications where versatile STANOILs will replace many special-purpose oils. You can reach this man through your local Standard Oil Company (Indiana) office. Contact him today. Or, if you wish, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

SEND FOR YOUR COPY

Here's help for bearings in "HOT WATER"

New booklet tells how STANOLITH Greases solve wet-hot problems

HOW TO LUBRICATE bearings which operate under extremely wet conditions, and at the same time, are subjected to high temperatures? If that is one of your problems, the booklet illustrated above holds the solution.

It tells you about the outstanding qualities of Standard Oil's new STANOLITH Greases. It explains why these lithium soap products—unlike soda soap or lime soap greases—will withstand *both* heat and water. The booklet contains evidence of this ability. It gives actual case histories of some of the many different jobs on which STANOLITH Greases have eliminated troubles caused by high temperatures, presence of steam or water, and high speeds. It also describes successful low-temperature service.

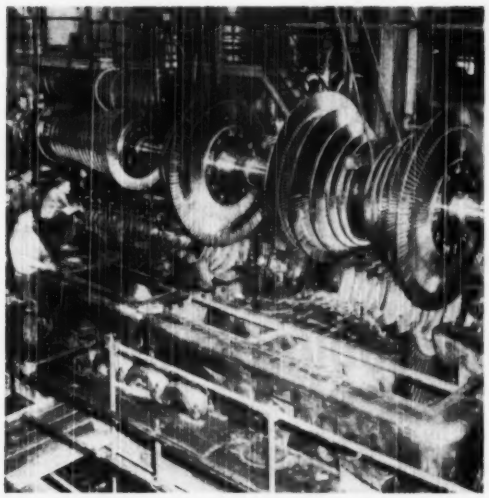
Study this wide range of applications. Discover how the two grades of STANOLITH Grease not only can solve difficult lubrication problems but can save you the cost and trouble of stocking and using a variety of special greases. Send for this information. Write for your copy of the STANOLITH booklet today. Simply address your letter to:

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

LETTERS FROM A TURBINE SPECIALIST—16

By C A LILLY, Jr and J E DOWNS, *Turbine Divisions, General Electric Co*



FOR HIGHEST EFFICIENCY all of steam flow should pass through blading; leakage along shaft must be kept at minimum

Turbine-Packing Wear Causes Loss In Unit Efficiency

Turbine Specialist
District Office

Dear Mr Specialist

We have several turbine-generator sets in our plant that have been running for a number of years. The question has been raised of whether or not the high-pressure and stage packings should be replaced at the next inspection.

I would appreciate your writing me a note giving the relative importance of high-pressure and stage-packing clearances on the efficiency of the units. I hope this will give us a rough guide for replacing packings.

Yours very truly,
ENGINEER

Dear Mr. Engineer

An accurate evaluation of the loss in over-all efficiency caused by packing leakages requires the consideration of a large number of variables. These include shaft diameter, type of packing, number of throttlings, disposition of leakage, stage energies, efficiencies, pressure drops, etc. It must be understood that the simplified rules given below are limited in accuracy.

We generally consider that a turbine in good condition, operated with reasonable care, will have radial packing clearances equal to 0.002 in. × shaft span between bearings in feet. This clearance is the average radial clearance around the shaft circumference. For usual types of impulse condensing turbines, 20,000 kw and larger, single cylinder or tandem compound, 3600 or 1800 rpm, the percent loss in over-all efficiency at rated load from having the formulated clearance instead of zero can be found approximately by the following equations:

$$\% \text{ loss from h-p end packing} = 5 \times \frac{\text{Rated kw}}{\sqrt{\text{Initial pressure}}}$$

$$\% \text{ loss from diaphragm packing for each stage} = \frac{0.6}{\frac{\text{Rated kw}}{\sqrt{\text{Initial pressure}}} \times \sqrt[3]{\text{Stage number}}}$$

Furthermore, the percent loss in efficiency varies directly with the clearance.

Applying these equations to a turbine rated 60,000 kw with initial steam pressure of 600 psig and shaft span of 15 ft, the percent loss in over-all efficiency with normal clearances of 0.030 in. would be as follows:

High-pressure end packing	0.5%
2nd-stage diaphragm packing	0.05%
5th-stage diaphragm packing	0.035%
12th-stage diaphragm packing	0.026%

If the packing clearances are 0.050 in. instead of 0.030 in., losses would be 1.66 times the above figures or:

High-pressure end packing	0.83%
2nd-stage diaphragm packing	0.083%
5th-stage diaphragm packing	0.058%
12th-stage diaphragm packing	0.043%

In other words, the improvement in over-all efficiency by reducing clearances from 0.050 to 0.030 in. would be 0.33% for the high-pressure end packing, 0.033% for 2nd-stage diaphragm packing, 0.023% for 5th-stage, and 0.017% for the 12th-stage. Summing up calculations for all stages would show the total effect of all the diaphragm-packing leakage about equal to the effect of the high-pressure packing leakage.

This gives a "rough and ready" method of predicting the approximate effect of changes in packing clearance on turbine efficiency.

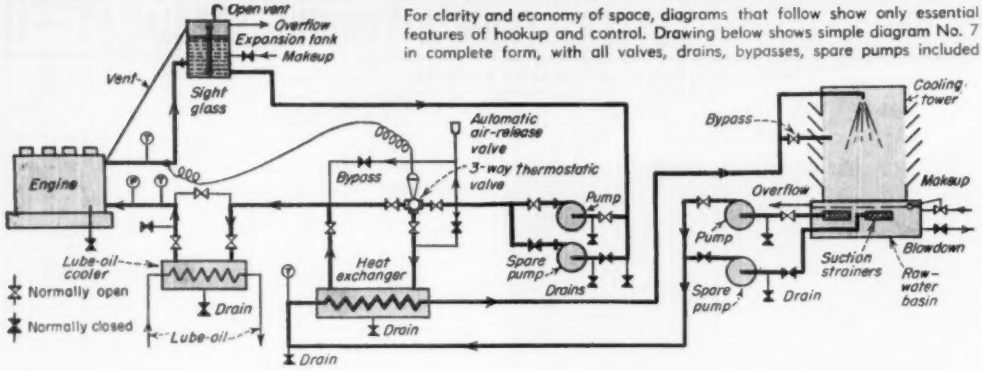
Problem of predicting the clearances during the period following renewal of packings must be given consideration. Factors influencing clearances include starting and stopping procedures, rate of load and temperature changes, and other conditions under which the unit operates.

Station operating data that give an indication of change in packing clearances with time should be useful in making this prediction. At any rate, judgment must be exercised in predicting how long and how much the clearances will be reduced as the result of new packings.

Sincerely yours,
TURBINE SPECIALIST

COMPLETE PIPING DIAGRAM FOR CLOSED SYSTEM WITH COOLING TOWER

For clarity and economy of space, diagrams that follow show only essential features of hookup and control. Drawing below shows simple diagram No. 7 in complete form, with all valves, drains, bypasses, spare pumps included



Diesel Instruments and Controls: 5

By EDGAR J KATES
Consulting Engineer, New York, N. Y.

How to Choose Your Cooling System

Best bet is to start by looking over all the possibilities. This article and the next permit you to do just that—they give, for the first time, a unique "dictionary" of layouts and controls

►WE'RE READY NOW to come to grips with the real business of cooling-system layout and control. Preceding articles covered the instruments and controls, and gave general principles to follow in applying them. To button up the job, this article and the next bring you a sort of "dictionary" of hookups.

Which System? In this unusually complete collection of hookups you should find one to fit your plant's needs. Which it will be depends on: (1) cost and availability of water (2) water purity (3) climate (4) space (5) need to regain heat. They affect choice thus:

For example, if there's plenty of *pure* water available at low cost, you've no need to recool. A simple open system does the trick. But use a bypass control to keep engine jackets at good working temperature. If you need heat recovery, you can use hot water direct from engine jackets.

If water is impure, use a closed system to keep raw water out of engine jackets. With original water recirculating without appreciable makeup, there is little danger of scale. If raw water is cheap and plentiful, use a heat exchanger, let raw water go to waste after it has cooled jacket water. When raw water must be conserved, apply a heat exchanger and recool raw water in a cooling tower or spray pond. Or use an evaporative cooler with jacket water flowing inside coils and raw water sprayed outside them.

Where water is very scarce (whether pure or not) recool jacket water in a water-to-air radiator. Essentially no makeup is required.

Climatic Conditions. These affect size and cost of cooling towers, evaporative coolers and radiators. Evaporative cooling depends on humidity of ambient air. Moist air takes up less vapor before becoming saturated. Hence, more air must be circulated to remove same amount of heat. High air temperature also cuts capacity because smaller temperature difference between water and air means less direct heat transfer.

Capacity of water-to-air radiators is not affected by humidity at all, because water isn't exposed. But it's directly affected by air temperature because cooling is done solely by water-to-air temperature difference.

Space Considerations. Cooling towers and evaporative coolers must be in open spaces where moist air given off can dissipate freely. It is difficult to use them in enclosed areas, like basements, because vapor clouds form. Ducts to carry air outside usually prove impracticable.

Radiators can be located more freely since they don't produce vapor. Warm air from radiator is not usually objectionable as temperature rise must be kept low to get maximum temperature difference for heat transfer. But radiators often cost more than towers or coolers, take more fan power.

Heat Recovery. Where heat can be used as warm air (space heating), water-to-air radiators prove simple, inexpensive, efficient. Dampers direct air flow as needed.

If you want heat in form of hot water, always use heat exchangers unless water is unusually pure. Otherwise, heavy makeup causes jacket deposits.

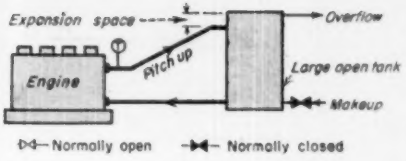
Because engine must always be safely cooled, exchanger used for heat recovery must usually be supplemented by some other means of recooling jacket water. You also need well-designed thermostatic control to hold satisfactory water temperature to process while maintaining correct engine temperature.

Dictionary of Diagrams. Following pages (and next article) comprise a unique dictionary of cooling-system layouts. Each simplified diagram has brief summary of features. Diagrams aim to show *fundamental* layout of cooling systems and correct application of instruments and controls (with exception of alarms, to be covered later.) For clarity and space economy, most diagrams omit details like drains, shutoff valves for maintenance work, bypasses around automatic valves, level gages on tanks, etc. Refer to preceding article which discussed them fully. For a complete piping diagram, see drawing above.

1 THERMO-SIPHON SYSTEM

FEATURES: Water is circulated by thermo-siphon effect, cooled by radiation from tank surface. No controls need be used.

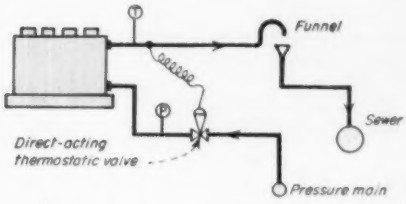
PROS and CONS: Suitable only for small engines and intermittent service. Flow rate through engine is low, temperature change is great. No loss of water.



2 OPEN CIRCUIT, DIRECT CONTROL

FEATURES: Water is supplied from pressure main and wasted to sewer. Changing rate of flow, with inlet and outlet temperatures essentially constant, provides control. Funnel at discharge indicates flow rate and warns of high temperature.

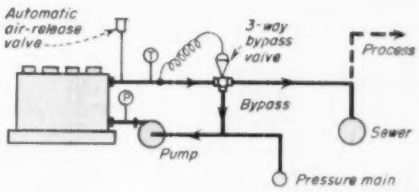
PROS and CONS: Because inlet temperature is that of the supply, temperature rise in jacket is usually too high. Low flow rate brings danger of vapor pockets. Raw water goes into engine jackets; if it contains mineral impurities scale will form. If water pressure fails, engine overheats immediately. For this hookup, water supply needs to be both cheap and pure.



3 OPEN CIRCUIT, BYPASS CONTROL

FEATURES: Water supply comes from pressure main. Discharge is under pressure also, can be forced to sewer or process. Flow rate through engine is essentially constant; bypass changes temperature of water entering engine jackets.

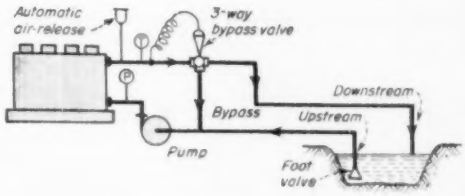
PROS and CONS: Pressure main supplies engine even if pump stops. Raw water flows through engine jackets, hence needs to be free from impurities. Ample flow gives small temperature rise, prevents vapor pockets.



4 OPEN CIRCUIT, BYPASS CONTROL

FEATURES: Water supply from running stream; water returns to stream. Essentially constant rate of flow through engine; bypass changes temperature of water entering jackets.

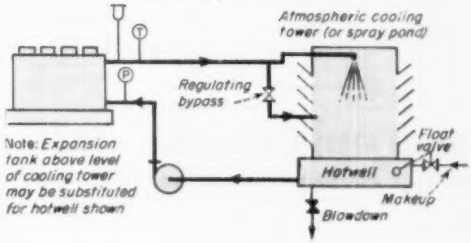
PROS and CONS: Water should be relatively free from impurities. Use of bypass control gives small temperature rise, avoids vapor pockets. Engine overheats at once if pump fails.



5 OPEN SYSTEM, WITH COOLING TOWER

FEATURES: Constant rate of flow through engine; cooling regulated by partially bypassing tower sprays. This scheme should not be used where freezing weather occurs.

PROS and CONS: Evaporation and windage from cooling tower amounts to about 0.5 to 1.0 gal of water per bhphr. This concentrates mineral impurities in water; unless blown down regularly, scale deposits in engine. Control of jacket temperature is rather crude.



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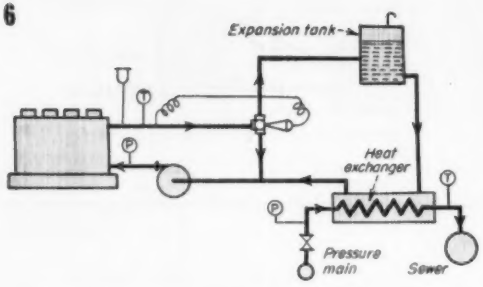
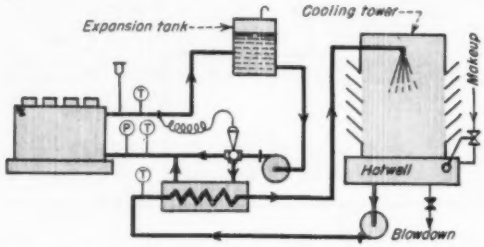


CLOSED SYSTEM, RAW WATER NOT RECOOLED

FEATURES: Jacket-water circuit is closed; same water recirculates. Raw water comes from pressure main, returns to sewer. Essentially constant rate of flow through engine.

PROS and CONS: Raw water can be impure (sea water, for example), but still needs to be cheap because it is wasted. Again engine enjoys benefits of bypass control.

7

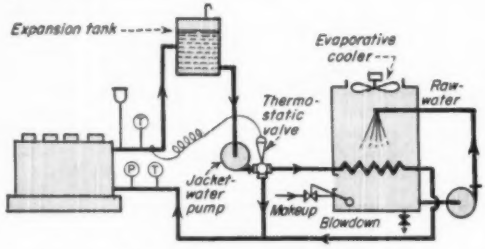


CLOSED SYSTEM, RAW WATER RECOOLED

FEATURES: Raw water is recooled in cooling tower or spray pond. Jacket water circulates in closed system under bypass control. Raw-water makeup runs about 0.5 to 1.0 gal per bhphr.

PROS and CONS: Raw water is conserved. Tower or pond can be at any elevation with respect to engine. Pressure on engine jackets is low. Temperature control is accurate. Small temperature rise in engine.

8

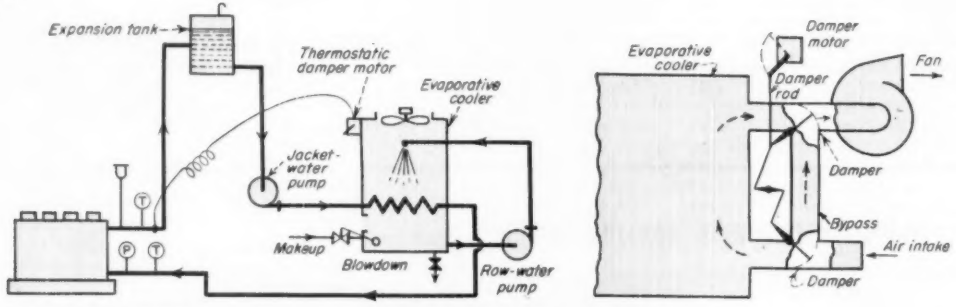


CLOSED SYSTEM, EVAPORATIVE COOLER

FEATURES: Closed system for jacket water includes coils of evaporative cooler. Bypass around these coils has thermostatic valve for jacket-water temperature control.

PROS and CONS: This hookup has same advantages as No. 7. In addition, evaporative cooler usually takes less space than cooling tower plus heat exchanger. Raw-water pump is small. Impure water may make heavy deposits on outside of coils.

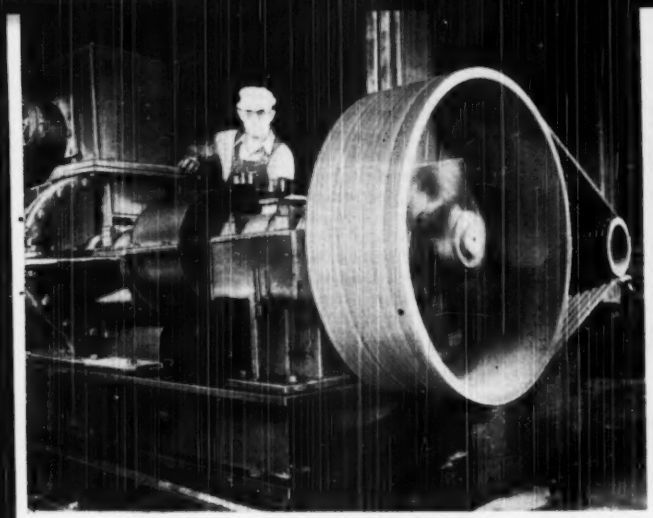
9



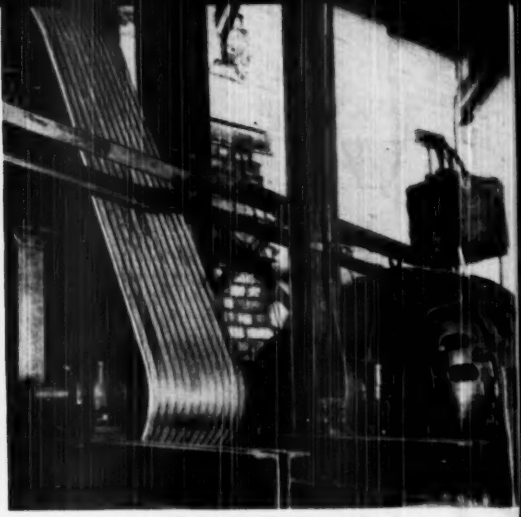
CLOSED SYSTEM, EVAPORATIVE COOLER (FOR COLD CLIMATES)

FEATURES: Jacket-water system is closed. Jacket-water temperature is controlled by a thermostatic motor operating dampers controlling air intake, discharge and bypass. (See damper diagram at right.)

PROS and CONS: This hookup has advantages of No. 8, plus the safety against freezing provided by shutting off cold air from cooler when engine isn't running. Raw water won't freeze while engine is running.



1 Large-speed reductions are easily handled by V-belts, as is done in this six-to-one drive on a motor-driven rotary blower



2 This 12-strand multiple V-belt connects 200-hp 575-rpm induction motor to 100-rpm line shaft

Engineer Your V-Belt Drives for Lowest-Cost Operation

Any one who knows simple arithmetic can engineer a V-belt drive for almost any job by these methods. Sample application is worked out step by step for most economical drive

By C J BUSACCA and F H RUMBLE
Texrope Drive Dept, Allis-Chalmers Mfg Co

► BASIC PRINCIPLES of V-belt drive engineering are widely accepted, and methods of selection are standardized. If suggestions and recommendations in catalogs of a reputable V-belt-drive manufacturer are followed, any engineer can select an adequate drive for almost any application. Perhaps many of these rules and tables are taken too much for granted. It might be well to study the factors that must be considered, explain why they are important, and what is likely to happen if they are disregarded.

V-Belt Drives. A typical V-belt drive has a driving and driven sheave, Fig. 1 and 2, both grooved for and using one or more endless V-belts. Power is transmitted by the wedging action between the groove walls and the sides of the belt. When correctly engineered, belts do not touch the bottom of the groove, Fig. 4. As the belt bends, its sides bulge but are confined within the metal V-groove walls as the belt turns the sheave. The high-pressure contact between groove walls and belt sides produces a viselike grip assuring non-slip operation.

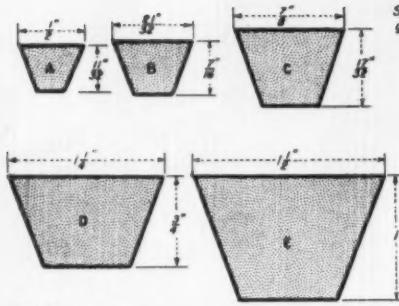
Good engineering of a V-belt drive is like good engineering applied to any field. It is the use of tested, proven methods for obtaining the most effective drive, at the lowest ultimate cost.

It involves many factors, including (1) the minimum recommended sheave pitch diameters for the different belt cross sections (2) arc of contact of the belts on the sheaves (3) service factors for different machines (4) horsepower ratings for the several belt cross sections (5) required versus nameplate horsepower of the power unit (6) choice of belt type for the specific conditions of operation (7) belt speed in feet per minute (8) correct number of belts.

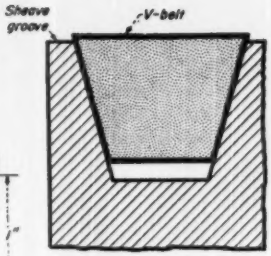
The best drive with the least upkeep cost is the one engineered according to the fundamentals presented in the catalogs. Their use insures transmitting maximum horsepower with lowest maintenance expense. The temptation to reduce the number of belts or sheave diameters is always present. Lower first cost does not mean lower over-all cost. Skimping on the number of belts or the sheave diameters shortens belt life and the purchaser pays later in increased maintenance costs. Under-belting a drive is false economy.

Size of Sheave. Don't use sheaves smaller than recommended minimum pitch diameters, table I. Here minimum pitch diameters are recommended for each width and thickness of the different belts, Fig. 3. Standard rubber V-belts are made of cord, fabric and rubber in proportions that each belt manufacturer thinks will wear longest under the strain of constant bending in operation.

The V-belt, bending in an easy, normal arc determines the smallest sheave diameter that may safely be used and that will not distort the belt. Bending in a smaller arc than the normal one distorts the belt and it generates excessive heat by internal friction. This causes the belt to deteriorate and the plies to separate. If recommended minimum- or larger-dia-

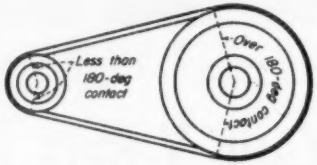


3 V-belts come in five standard cross sections, listed A, B, C, D and E



4 Sheave grooves are about same size as belts, cut about 3/16 in. deeper

5 V-belts are rated on the basis of a 180-deg contact arc on both sheaves



6 Belt ratings are adjusted by factor for reduced contact on small sheave

meter sheaves are used, the belt is not bent so sharply, and heat and internal friction are reduced. In table I, minimum pitch diameters, determined by extensive tests in the laboratory and in the field, were found satisfactory in practice.

The question then arises, "Can sheaves smaller than those recommended be used? Of course they can, but they are not economical. It is better to use sheaves larger than the recommended minimum because an increase of 1 or 2 in. in pitch diameter substantially increases belt life. When V-belt drives are engineered, it is well to consider belt replacement. Larger sheaves do cost more than smaller ones, but the cost of even one set of replacement belts generally offsets the increased first cost of larger sheaves. Longer belt life and less frequent replacement means reduced over-all cost.

Arc of Belt Contact. Table II shows "Arc of Contact-Correction Factors." Practically every V-belt catalog has this table or one similar to it. But the questions are asked, "Why are these factors important? Why should they be used?"

Horsepower ratings for all drives are based on a 180-deg arc of contact of the belt on the sheaves, Fig. 5. If the arc is less than 180 deg on the small sheave, Fig. 6, belt surface in contact with this sheave is reduced and its horsepower accordingly, as in the table. If the arc of contact is 140 deg, the belt will transmit only 0.89 of the load that it would carry with 180 deg. Hence, it may be necessary to use more belts to transmit the same horsepower when the belts have 140-deg contact than if they had 180-deg contact. If the arc factor is not considered, the drive will not have enough belts to transmit the required power, and belt life will be reduced.

Kind of load to be driven and the driving unit is a third factor to consider when engineering a drive. Table III gives service factors to cover overload and shock load conditions in excess of 100% of normal load. Figures in this table are averages for different types of motors and load conditions. Complete service-factor information showing the correct factor for a specific motor and certain torque and starting conditions is found in most V-belt drive catalogs.

Drive Horsepower. Multiplying motor rated or nameplate horsepower by the service factor gives the horsepower on which to base the drive calculations. If the service factor for an application is 1.4 and it is disregarded when engineering the drive, the latter will not have enough belts and will have a short life under the strain of shock or peak loads.

Horsepower ratings and speed characteristics for the different belt cross sections must also be considered when engineering a drive, tables IV and V and Fig. 3. These ratings were determined by extensive tests and it is not generally practical to use cross sections other than those shown for a given horsepower and motor speed. Cross sections shown for a given speed and horsepower were selected as the best, all factors considered. Belt speed, drive cost, bearing loading from sheave overhang on the shaft, dynamics of the drive—were taken into account when the tables were prepared. It is, therefore, important that these tables be used when engineering a drive.

Operating Conditions. Also, when selecting a V-belt drive, conditions under which the drive is to operate must be studied. V-belt and sheave manufacturers have long been aware of the varying operating conditions and have engineered the drive parts to meet these needs. If your drive must operate where explosion hazards exist, use belts that have a cover impregnated with a static-conducting material. These belts conduct static charge to the motor or the driven-unit frame where it can bleed to ground. Standard V-belts may build up a static electrical charge and cause a spark. Use of static-conducting belts will reduce this hazard.

If you need high horsepower per belt or low stretch, maybe you should use a steel cable or the high-capacity belts with 40% more horsepower-transmitting capacity than standard ones. If the drive must contact oil, order special oil-resistant or oil-proof belts, which prevent swelling and rubber deterioration. If in doubt consult the V-belt manufacturer.

Variable-Speed Sheaves. In addition to constant-speed sheaves, some V-belt manufacturers offer variable-speed sheaves. Sheaves of this type permit separating or closing the groove walls, causing the belts to ride lower or higher in the grooves. Changes in groove width change sheave pitch diameter and, therefore, change the output speed. Variable-speed sheaves are available in stationary (adjusted while the machine is shut down) or motion control (adjusted while the machine is operating) for use with standard size or wide-range V-belts. Standard-range variable-speed sheaves give up to a 25% speed change and wide-range variable-speed sheaves give up to 100% speed change per sheave.

Normal safe-operating speed for V-belt drives is from 1000 to 5000 ft per min. When a drive operates below 1000 ft per min surface speed, the horsepower that each belt can transmit is so low that the number of belts needed to drive the load becomes excessive. Above 5000 ft per min, horsepower that belts can transmit decreases, partly because centrifugal force tends to throw

I: RECOMMENDED SIZE OF DRIVE SHEAVE

Belt section	Minimum pitch diameter, in.	Maximum pitch diameter
A	3.0	Sheaves that are large enough to give a belt speed of over 5000 ft. per min. are not recommended.
B	5.4	
C	9.0	
D	13.0	
E	21.6	

II: ARC-OF-CONTACT CORRECTION FACTORS

Arc of contact, deg:							
180	170	160	150	140	130	120	110
Factors, V-to-V drives:							
1.00	0.98	0.95	0.92	0.89	0.86	0.83	0.79
Factors, V-to-flat drives:							
0.74	0.76	0.79	0.82	0.84	0.86	0.83	0.79

III: SERVICE FACTORS FOR V-BELT DRIVES*

Applications	Service factors
Agitators, paddle-propeller	1.0 - 1.2
Brick and clay machinery	1.2 - 1.6
Bakery machinery	1.0 - 1.2
Compressors	1.2 - 1.4
Conveyors	1.0 - 1.6
Crushing machinery	1.4 - 1.6
Fans and blowers	1.2 - 2.0
Flour, feed and cereal-mill machinery	1.0 - 1.4
Generators and exciters	1.2
Laundry machinery	1.2
Line shafts	1.4 - 2.0
Machine tools	1.0 - 1.4
Mills	1.4 - 1.6
Oil-field machinery	1.2 - 1.6
Paper machinery	1.2 - 1.6
Printing machinery	1.2
Pumps	1.2 - 2.0
Rubber-plant machinery	1.4 - 2.0
Screens	1.2 - 1.4
Textile machinery	1.2 - 1.8

*The service factor selected depends on peak and shock loads in excess of 100% full load. Where peak and shock load are small, use the smaller service factor. For severe loads, use the higher service factor. Reversing service or line-start motors require an overload factor of 1.2.

IV: HORSEPOWER OF A, B, C, D AND E BELTS

Motor sheave pitch dia, in.		Belt speed, ft. per min.							
		1500	2000	2500	3000	3500	4000	4500	5000
	3.0	1.0	1.3	1.5					
	3.4	1.1	1.5	1.7	2.0				
A	3.8	1.3	1.6	2.0	2.2	2.5			
	4.2	1.4	1.8	2.1	2.4	2.7	2.8		
	4.6	1.4	1.9	2.3	2.6	2.8	3.0	3.2	
5.0 or over		1.5	2.0	2.4	2.7	3.0	3.3	3.4	3.4
	5.4	2.0	2.6	3.1	3.5	3.8	4.0	4.0	3.8
B	5.8	2.1	2.8	3.3	3.8	4.1	4.4	4.4	4.3
	6.2	2.3	2.9	3.5	4.0	4.4	4.7	4.8	4.7
	6.6	2.4	3.1	3.7	4.3	4.7	5.0	5.1	5.1
7.0 or over		2.5	3.2	3.9	4.5	4.9	5.3	5.4	5.5
	9.0	4.2	5.5	6.6	7.6	8.4	9.1		
C	10.0	4.6	6.1	7.3	8.5	9.4	10.3	10.7	
	11.0	5.0	6.5	8.0	9.2	10.3	11.3	11.8	12.2
12.0 or over		5.3	7.0	8.5	9.8	11.0	12.2	12.7	13.2
	13.0	7.5	9.7	11.6	13.3	14.6	15.6		
D	14.0	8.2	10.7	12.9	14.4	16.5	17.8		
	15.0	9.0	11.7	14.1	16.3	18.1	19.6	20.3	
	16.0	9.6	12.5	15.1	17.5	19.5	21.3	21.1	22.6
17.0 or over		10.1	13.2	16.0	18.6	20.7	22.8	23.5	24.4
	21.0	12.5	16.2	19.6	22.7	24.9	26.6		
E	22.0	13.2	17.2	20.8	24.0	26.6	28.5		
	24.0	14.5	18.9	23.0	26.5	29.5	31.9	33.5	
	26.0	15.6	20.3	24.7	28.6	32.0	34.7	36.7	37.9
28.0 or over		16.5	21.6	26.3	30.5	34.2	37.2	39.5	40.9

V: MOTOR RATINGS AND V-BELT DATA

Motor hp	Motor or driven-machine speed whichever greater							
	1800	1450	1200	900	750	600	514	450
½-¾	A	A	A	A	B	B	B	B
1-1½	A	A	A	A	B	B	B	B
2-3	A	A	A	B	B	B	B	B
5	A	A	A	B	B	B	B	B
7½	B	B	B	B	B	B	B	B
10	B	B	B	B	C	C	C	C
15	B	B	B	B	C	C	C	C
20	B	B	B	B	C	C	C	C
25	C	C	C	C	C	C	C	C
30	C	C	C	C	C	C	C	C
40	C	C	C	C	C	C	C	C
50	C	C	C	C	D	D	D	D
60	C	C	C	C	D	D	D	D
75	C	C	C	C	D	D	D	D
100	C	C	D	D	D	D	E	E
125	C	C	D	D	D	D	E	E
150	C	C	D	D	D	D	E	E
200	C	C	D	D	E	E	E	E
250 and over	C	C	D	D	E	E	E	E

the belts out of the grooves and reduces their wedging action.

How to Select Belts. Now let's apply these principles to selecting a V-belt drive for an application. Assume a 25-hp 1160-rpm line-start general-purpose squirrel-cage motor is to drive a 430-rpm ventilating fan on about 25-in. center distance. Table V recommends a C-section belt for a 25-hp 1160-rpm motor. Table III gives a service factor of 1.2 for a motor-driven fan, but as the motor is line-start an additional factor of 1.2 is used. Then the actual service factor is $1.2 \times 1.2 = 1.44$. Actual horsepower on which the drive should be designed is $25 \times 1.44 = 36$ hp.

When selecting the sheaves determine their size so two stock ones may be used if possible. Speed ratio is 1160 ÷ 430 = 2.71. From table I we find that 9 in. is the minimum recommended sheave size for a C-section belt. A sheave larger is preferred if a stock size is available. Try a 11.0-in.-motor sheave. Then the driven sheave should be 11x2.71 = 30 in. in diameter. Both 11- and 30-in. sheaves are standard size as can be found by consulting sheave tables.

Length of the belts can be determined by the formula:

$$L = 2C + 1.57\ (D + d) + \frac{(D-d)^2}{4C}$$

where L is pitch length of belts, D the pitch diameter of the larger sheave, d the pitch diameter of the smaller one, and C, the center distance between sheaves, all in inches. Then:

Belt length $L = (2 \times 25) + 1.57\ (30 + 11) + (30 - 11)^2 \div (4 \times 25) = 117.98$ in. Nearest standard C-section belt length to this is 122 in., which requires a slightly longer center distance. This can be calculated with the formula:

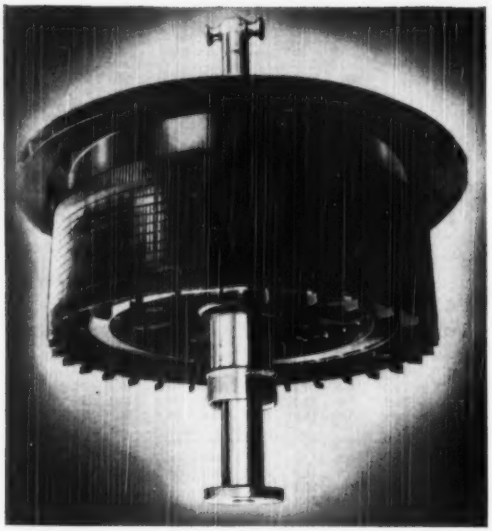
Center Distance $C =$

$$\frac{L-(D+d)1.57 - \dfrac{D^2-d^2}{1.57\ (L-R)}}{2}$$

where R is the sheave diameter ratio, 2.71. Then,

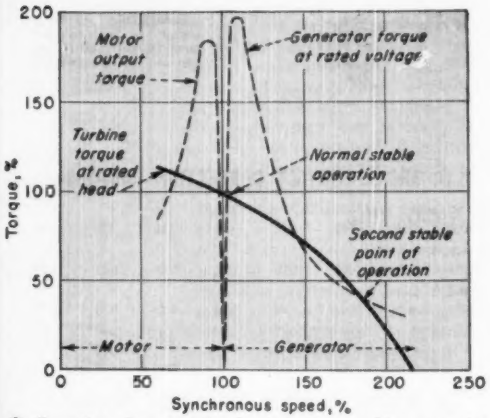
$$C = \left[122-(30+11) \times 1.57 - \frac{30^2-11^2}{1.57 \times (122-2.71)}\right] \div 2 = 27 \text{ in.}$$

(*Continued on page* 196)

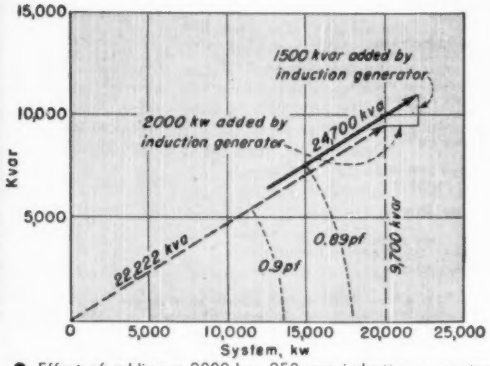


1 Rotor and stator for 1800-kw vertical induction generator. Resistance of squirrel-cage winding is less for induction generator than for induction motor. Splice box at stator's left handles leads to speed switch, and temperature relays

MACHINE DESIGN DECIDES GENERATOR PF



2 Operating characteristics for induction machine as motor and generator. Normal operation is near synchronous speed



3 Effect of adding a 2000-kw, 250-rpm induction generator to 20,000-kw .90-pf system. Note effect of system pf

Induction Generators for Small Loads

Asynchronous generators are far from common. But they're fitted for small hydroelectric installations. The induction generator must be operated in parallel with synchronous generators. They cannot furnish lagging kvar to motor loads

By H H ROTH, *Engineer, Motor & Generator Section, Allis-Chalmers Mfg Co*

► INDUCTION GENERATORS are suited to some small hydroelectric plants. They have also been used for special process work, as in some oil-refining processes. But their greatest future application probably lies in the hydroelectric field, particularly in small unattended stations.

Construction. The induction generator is an asynchronous generator. That is, when generating power it does not operate at a synchronous speed corresponding to its number of poles and frequency. It is fundamentally an induction motor operated above its synchronous speed. Any 3-phase induction motor can be operated as an induction generator if driven

above its synchronous speed by a suitable prime mover. It must be connected to a system on which synchronous generators are operating.

Squirrel-cage rotor windings are always used in induction generators. The winding is designed with a relatively low resistance to improve generator efficiency. A wound-type rotor can also be used, but it offers no advantage. Among its disadvantages are higher first cost, greater maintenance because of collector rings and brushes, and possibility of insulation failure in rotor winding.

Fig. 1 shows the stator for a vertical induction generator. This unit was recently installed in an unattended hydroelectric plant. Stator is similar to that of a synchronous generator.

Rotor for this induction generator is above the stator. It is similar to a squirrel-cage induction motor of similar rating. Only difference is in the mechanical design of the rotor since it must withstand the overspeeds met if a hydraulic turbine is prime mover.

Theory. An induction motor, connected to a power source and operated at no load, runs at a speed slightly under its synchronous speed. And it draws kva at a relatively low power factor from the line. This kva consists of the exciting current, reactive kva, required to provide excitation of the motor, and a small amount of power, kw, necessary for the machine's no-load losses.

If this induction motor is driven at its synchronous speed, by a power source, while still connected to the line, it will continue to draw its exciting current. But it will no longer draw kilowatts from the line, since its losses are now supplied by the prime mover. It is then analogous to a synchronous generator connected to a system but operating at no load.

If prime mover's speed is increased, and induction motor driven slightly above its synchronous speed, the system to which it is connected begins to act as an electrical brake and attempts to hold down speed of induction machine. In so doing, the system absorbs kilowatts from the induction machine. It is no longer a motor, but has become an induction generator.

The fundamental theory is straightforward. When the induction motor is driven above synchronous speed the slip becomes negative. The rotor conductors will then cut the rotating field flux in a direction opposite to that which occurred when the machine operated as a motor. Rotor currents are then reversed with respect to the direction they had when the machine operated as a motor.

By transformer action these rotor currents induce a voltage, and consequent current, in the stator. This current is substantially 180 deg out of phase with the energy component of the stator current that existed when the machine operated as a motor.

Further increase in speed reverses power output until its rated output is obtained at about 3% above synchronous speed. It is assumed that system frequency has remained constant.

Induction generators must be operated in parallel with synchronous generators since the latter are a necessary source of exciting current for the induction machine. Also, the synchronous generators must establish and hold system frequency and voltage. Operator has no control over voltage output of an induction generator; it can operate only at the voltage to which it is connected.

Synchronous generator output rating is in kva while the induction generator is always rated in kw output. Unlike synchronous generators, the power factor at which an induction generator operates is not determined by the electrical load; it is fixed solely by the machine's design. Its pf will vary with its power output, just as pf of an induction motor varies from no load to full load. Pf of an induction generator is about the same as an induction motor of comparable size and speed.

Because it operates at an inherently fixed power factor, the induction generator cannot furnish reactive kva to induction motors. These induction motors must obtain their reactive kva from synchronous generators, which is another reason why the induction generator must operate in parallel with synchronous generators.

Operation. An induction generator does not need an exciter. It draws its excitation from the synchronous machines on the same system in the form of kilovars. When not operating in parallel with synchronous generators, it has no source of excitation, and consequently generates no voltage or power. While it is theoretically possible to operate an induction generator isolated from synchronous generators by using capacitors to furnish excitation, this has been found impractical.

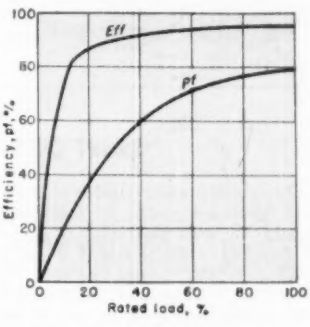
Since an induction generator receives no excitation until it is connected to the system, it cannot be synchronized with the system in the manner commonly used with synchronous generators. Standard starting practice is to bring generator up to synchronous speed and then close the circuit breaker connecting it to the system. The circuit-breaker closure is usually activated by a speed-switch mounted on the generator. Gates of the hydraulic turbine are then adjusted until desired loading is obtained.

In some hydroelectric installations, the turbine is not equipped with a speed governor. In such cases turbine gates are set wide open, and unit then operates as a base-load machine, delivering a constant-power output to the system. Should there be variations in amount of water flow, or in the hydraulic head on the turbine, the unit develops whatever power it can from the water available. In selecting a generator for such an installation, it is only necessary to make sure the generator has sufficient capacity to handle the maximum possible power output of the turbine.

If an induction generator loses its load because of system fault or being taken off the line by its protective relays, the unit will overspeed. Its overspeed switch will start closing the turbine gates, shutting down the machine. When normal conditions are restored, the unit may again be started and put on the line.

It is best to have an induction generator operating at its synchronous speed at the time it is connected to the system. If speed is below synchronous, it will operate temporarily as an induction motor to accelerate the prime mover to synchronous speed. If speed is above synchronous speed by more than the rated slip, generator will be momentarily overloaded. Either condition will cause a greater line disturbance than if the induction generator were to be connected to the system at its synchronous speed.

One peculiarity of induction generators is that under certain conditions, a second stable operating speed may exist that is much higher than rated speed, Fig. 2. This point depends on



4 Pf varies with the generator output regardless of connected system's pf

generator characteristics as well as speed-torque characteristics of the prime mover. It is likely to be around twice synchronous speed. For units driven by hydraulic turbines, this characteristic cannot be entirely overlooked since there is a possibility the unit may reach this speed or even higher speed during runaway.

Characteristics. Speed-torque characteristics of both generator and hydraulic turbine, Fig. 2, are for a specific installation that uses a propeller-type turbine with a relatively high runaway speed. The turbine curve is for the normal rated turbine water head. Shown with broken lines are the speed-torque curves of the induction generator at speeds both below and above its synchronous speed. Points indicated by arrows are stable operating points for this particular unit. These stable points at high speed result when the turbine's torque output just equals torque required to drive the generator.

An overspeed switch can be provided to prevent operating at this second stable point. This switch will trip the unit off the line and start closing turbine gates when speed exceeds a predetermined amount. Normally, overspeed occurs only upon loss of generator load. Hence the overspeed switch would be connected in the control circuit to prevent generator circuit breaker from reclosing as long as the unit is operated above its rated speed. If overcurrent relays are used for generator protection, they would also prevent operation at the high-speed stable point, since the generator stator current at this speed would be greatly in excess of the machine's rated current.

Remember turbine operation at higher or lower than rated head changes the turbine torque curve accordingly. Operation of the induction generator at other than its rated voltage causes corresponding changes in the generator torque curve.

During a system fault, the induction generator cannot deliver any sustained fault current to the system. When system voltage drops to zero, the short-circuit kva produced by the induction generator also drops. While certain system disturbances may cause two synchronous generators to pull out of step with each other, such disturbances do not greatly affect the induction generator. Chief effect of system disturbances on the induction generator is possible excitation loss.

Control. Simplification of switchgear and control equipment is one advantage of induction generators, particularly for unattended stations. Such a plant needs no exciters, no collector rings or brushes, no synchronizing equipment, and possibly no speed governor on the turbine. Absence of these parts not only simplifies the generating unit, but is also reflected in the resulting simplification of the control equipment. This type plant lends itself to remote control from some adjacent attended plant. Such simplified plants may justify development of small rivers on a stream flow basis, with one operator dividing his time among several plants.

Cost of an induction generator is about the same as for a comparable 80% of synchronous generator, without exciter. Generator efficiency is about the same. But plant simplification resulting from the use of the induction generator may mean much saving in over-all plant cost, operation.

A few years ago, during a shortage of hydroelectric power in California a considerable amount of power was generated by induction generators. In this case standard induction motors were used as generators, coupled or belted to internal combustion engines. While these units were of relatively small capacity individually, total power generated from many such plants was of great help in carrying peak loads. While the generation of electric power in this manner is not economical, the induction motors and internal combustion engines are available for short delivery, and offer a source of prompt emergency power when unforeseen power shortages occur.

Phase-Sequence Check. In putting an induction generator on the line for the first time, its phase rotation must be carefully checked. This cannot be done, however, with methods commonly used for synchronous generators, since the induction generator cannot develop any voltage when isolated from the system. Hence it is not possible to check phase rotation by any method depending on a potential between generator and system.

But there are several methods that can be used for checking phase sequence. And these all depend on observation of direction of mechanical rotation when the induction generator is energized from the system. If there is a synchronous generator in the same or an adjacent plant, and if a circuit between these two machines can be isolated from the system, a phase sequence check can be made thus:

With the two machines connected electrically, and with the synchronous generator operating at normal frequency, its field current is gradually increased. The induction generator starts as an induction motor as soon as voltage is high enough to permit development of sufficient starting torque. If the induction generator rotates in the same direction as it will when normally driven by its prime mover, phase sequence is correct. This test may be made with the induction generator disconnected from its prime mover.

If system layout does not permit using this method, you can get the same results with stepdown transformers to apply reduced voltage to the induction generator. With the prime mover disconnected, 35% voltage applied to the generator should give ample starting torque for the test.

If the induction generator is connected to the system through a transmission line having considerable capacitance, a phase-sequence check can be made by connecting the generator to the transmission line with far end of line disconnected from the system. If the induction generator is then brought up to speed, it will generate a voltage dependent upon the line capacitance. This voltage will most likely be quite different from normal voltage. But it will probably be enough to start a small induction motor connected near the generator terminals. Direction of rotation of this small motor may be observed and then checked against its rotation with the induction generator shut down and the line energized from the system.

SHORT CUTS IN ARITHMETIC

To square a whole number plus ½, add ¼ to the product of the whole number by itself plus one.

Thus $2\frac{1}{2} \times 2\frac{1}{2} = 2 \times 3 + \frac{1}{4} = 6\frac{1}{4}$.

To get the product of two consecutive numbers ending in ½, square the larger whole number and subtract ¼.

Thus, you will find that $19\frac{1}{2} \times 20\frac{1}{2} = 20 \times 20 - \frac{1}{4} = 399.75$.

Product of two whole numbers differing by 2 is square of their average minus 1.

Thus, $29 \times 31 = 30 \times 30 - 1 = 899$.

If interested, you can prove all these rules by algebra.

Ira A Butcher

ELECTRONICS FOR THE POWER ENGINEER

By F. A. ANNETT, *Associate Editor*

32—Magnetic-Drive Control: Part 2

► TO CONTINUE OUR STUDY of electronic control of the output speed of magnetic drives we will consider one used on eddy-current drives. Up to 75 hp, these magnetic drives and their motors are combined into a single unit, with the motor supported on the drive, like a gearmotor. From 75 hp up to units of several thousand horsepower capacity, motor and drive are separate units.

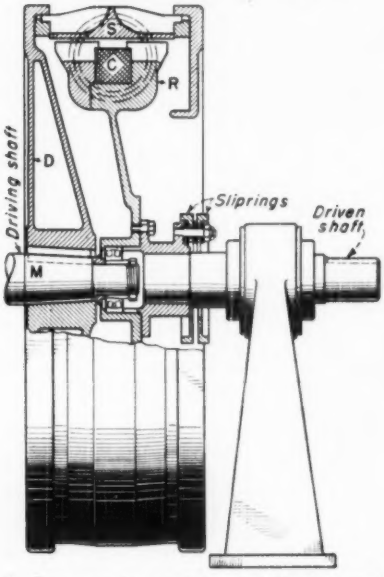
Eddy-Current Drives. Fig. 1 is a cross section through an eddy-current drive, also known as an eddy-current clutch or electric coupling for adjustable speed. Driving member is a steel drum *S* carried on a disk *D*, keyed to the motor shaft *M*. Field magnet or output member has a single coil *C* on a magnetic ring *R*, supported on the driven shaft. When the coil is energized a magnetic flux interlinks the two elements as dotted lines indicate.

Speed Control. Output speed of these drives can be adjusted by controlling the magnetizing coil's excitations. At rated load and full excitation, output speed is 3 to 4% less than motor speed. Decreasing the exciting current lowers output speed. So by adjusting the exciting current, output speed can be changed within design limits of the drive. Excitation current is adjusted manually or by several other means including electronic control.

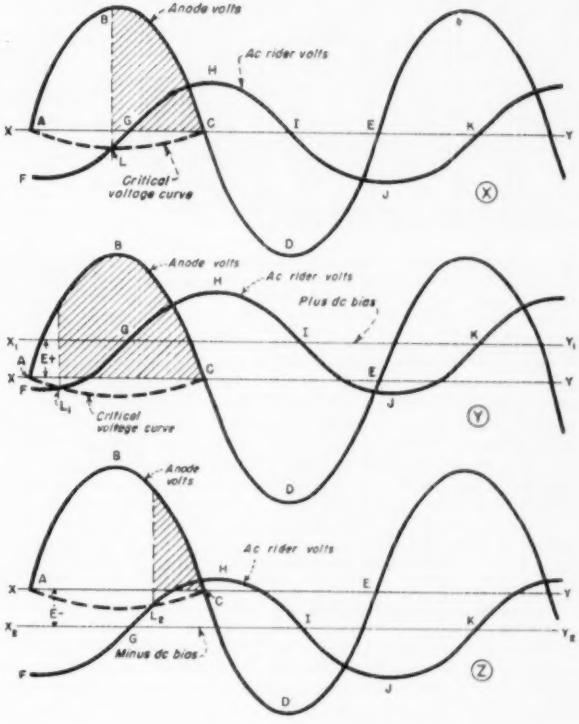
Electronic control has several advantages: It (1) is easily applied (2) can supply the dc exciting current and (3) can hold speed practically constant at any setting. Fig. 3 shows a Dynamatic Corp's magnetic drive and electronic control as applied in a Louis Allis Co's ac adjustable-speed drive. Main rectifier tube T_1 is a gas-filled grid-controlled half-wave unit, which fires alternately with discharge tube *T*. The latter is both a continuation and discharge tube for the dc output of tube T_1. Let us study this part of the control first.

Starting Circuits. Closing the starting contactor energizes the motor and it comes to speed without load. When the

Adjustable-Speed Eddy-Current Magnetic Drive and Its Control Voltages

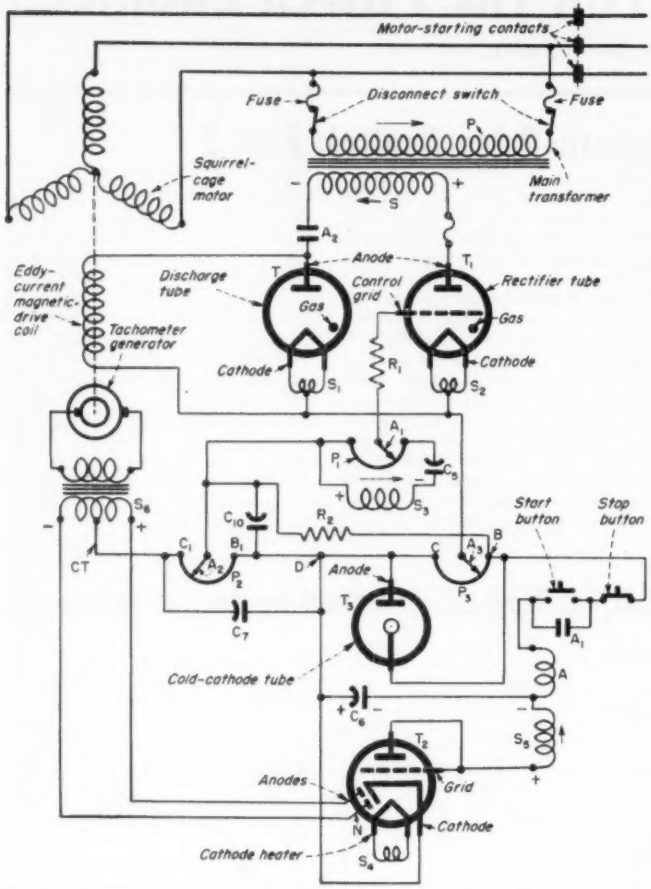


1 Cross section through an adjustable-speed eddy-current drive, also an electric coupling



2 Voltage curves for magnetic-drive electronic control. *X*, ac rider on tube's grid without dc bias cuts critical-volts curve at *L*. *Y*, ac rider on plus dc bias. *Z*, ac rider on minus dc bias

Wide-Range Electronic Speed Controller



3 An adjustable-speed magnetic-drive electronic control. The main rectifier tube is gas-filled grid controller and conducts alternately with the discharge tube

disconnect switch is closed it connects the main transformer to the motor leads. This transformer, in addition to its power secondary S, has secondaries S_1, S_2, S_3, S_4 and S_5. For simplicity, these are located at the most convenient places in the diagram instead of at the primary winding P. Secondaries S_1, S_2 and S_4 heat the cathodes of tubes T and T_1 and T_2. Tube T_3 has an indirectly heated cathode so when it is ready for service, T and T_2, with directly heated cathodes, are also ready.

Closing the start button completes a circuit for the magnetic contactor coil A. When secondary winding S_5 has the polarity shown, current flows through coil A, start button, cold-cathode tube T_3, cathode and anode of T_2 to + on S_5. Energizing coil A closes contacts A_1 and A_2. Closing contact A_1 forms a holding circuit around the start button so it can be released while the starting circuit remains energized. When A_2 closes it connects the rectifier to secondary S to energize the magnetic-drive coil.

Closing the start button also completed a circuit through speed-control potentiometer P_3, tube T_3 to + on S_5. A third circuit is through R_2 part of the maximum-speed potentiometer P_2, through T_3 to + on S_5. Cold-cathode tube T_3 holds constant-voltage across potentiometer P_3 to insure stable speed control, as will be shown later.

Rectifier Circuits. When secondary S has the polarity shown, current flows through A_2, the eddy-current magnetic drive's coil, cathode to anode of tube T_1 to + on S. While current increases through the magnetic-drive coil its magnetic field increases. When transformer polarity reverses, tube T_1 does not conduct. But induced voltage in the drive's coil keeps current flowing through discharge tube T, until transformer polarity reverses and T_1 comes into service again. Using a discharge tube connected in reverse to the rectifying tube forms what is known as a free-wheeling circuit.

Tube T forms a low-resistance circuit in parallel with the drive coil to keep its discharge voltage low and protect the rectifying tube from excessive induced voltage. It also acts as a filter to smooth out current flow through the coil and in effect causes tube T_1 to act as a full-wave rectifier.

Control of Output Speed. Grid of rectifier tube T_1 controls the voltage applied to the drive coil and therefore the output speed. Grid control is by a phase-displaced ac rider voltage on a dc bias. This is made clear by Fig. 2*X* to 2*Z*. Curve *ABC* represents the voltage applied from cathode to anode of rectifier tube T_1. Curve *FGHI* is the ac rider voltage applied to the grid. This rider is supplied by transformer secondary S_3 connected to capacitor C_9 in series with potentiometer P_1.

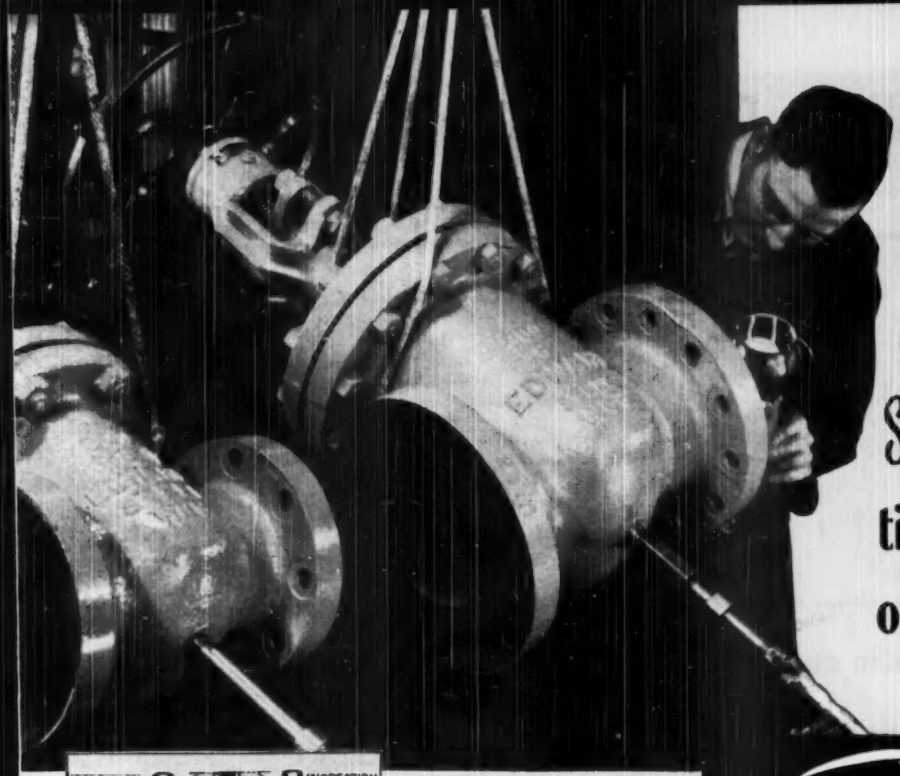
Assume this network is so grouped that its voltage is 100 deg out of phase with the cathode anode volts *ABC*, as indicated by curve *FGHI*, Fig. 2*X*. Dotted curve *AC* represents the critical voltage of the tube. As long as the grid is held more minus than this curve the tube cannot conduct. Ac rider curve *FGHI* crosses the critical at *L*, and the tube conducts for the period represented by the shaded area.

Plus Dc Bias. If a plus dc bias equal to $E+$ is applied to the grid of T_1, it will have the effect of lifting the ac rider as in Fig. 2*Y*. Now, instead of time line *XY* being the zero of the ac rider, line X_1Y_1 is, which represents the dc bias. From *F* to *G* the ac rider voltage opposes the dc volts so this part of the curve is below X_1Y_1.

During period *GHI* the ac rider volts are in the same direction as the dc bias and the two add so this curve is above zero line X_1Y_1. The ac rider's voltage curve now crosses the critical at L_1 and tube T_1 conducts for the period represented by the shaded area, which is much larger than in Fig. 2*X*. If the dc bias is further increased, tube can be made to fire at the beginning of anode voltage curve *ABC*.

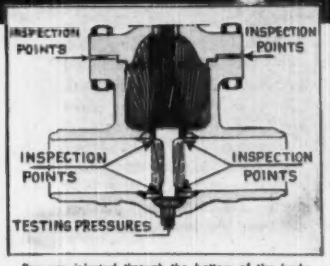
Minus Dc Bias. If we apply a minus dc bias to the grid it will have the effect of lowering the ac rider as in Fig. 2*Z*.

(*Continued on page* 156)



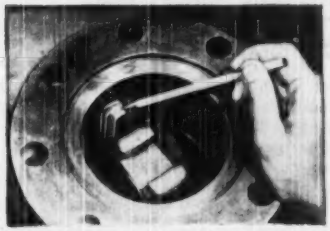
EXCLUSIVE TEST METHOD PROVES *Simultaneous* tight seating of both faces of

Edward GATE VALVES

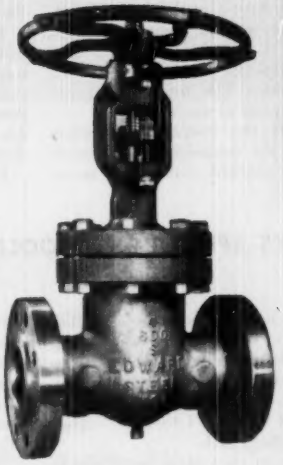


Pressure injected through the bottom of the body surrounds seats, yet leaves both ends open for simultaneous inspection in Edward testing method.

Arrows show where Edward cut clearances between wedge and guide ribs to eliminate wedge drag on seats. With Edward gate valve, partial turn of handwheel transfers load from seats to wedge guides.



Edward gate valve wedge guides are welded to body after seats are in place; therefore moving parts are accurately located. Seat rings are also welded in to prevent leakage between seats and body.



When Edward engineers began the design of a new series of steel gate valves, they tested other makes. Many of them were tight on one seating face or the other, but few were tight on both faces.

To build really tight gate valves, Edward engineers discarded the conventional method of casting guide ribs as part of the body and instead developed a new technique for welding the ribs into the body *after the machined seating faces were in place*. This, they demonstrated, reduced machining tolerances, eliminated wedge drag on the seating faces, and cut wear. They were also sure it meant a tighter valve.

But how to prove it? The result was the testing method shown above. Now, *all* Edward gate valves are tested with both ends open for simultaneous inspection, and both seating faces must be tight simultaneously.

The new Edward gate valves incorporate many other plus-value features, such as welded-in seats, one-piece bonnets, ball bearing yoke bushings in most sizes, and Stellite faced seating surfaces. With Edward, these features are standard construction.

For more details write for Catalog 12-E.

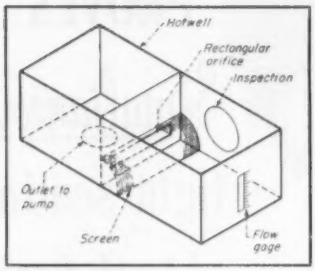
Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO EAST CHICAGO, INDIANA

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

SCREEN GUARDS HOTWELL'S ORIFICE PLATE FROM CLOGGING

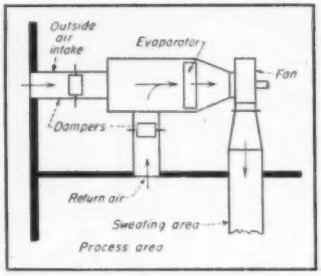


MATERIALS HAVE accidentally found their way into our condenser steam space during turbine overhauls. We usually take elaborate precautions to prevent this, but oversights occurred twice. Once a large rag found its way through the vertical orifice plate, see sketch, and fouled the condensate pump. The second time, a small board blocked the orifice completely. Both times the unit was forced out of service at considerable inconvenience and expense.

To prevent a recurrence our Assistant Chief suggested placing a screen ahead of the orifice plate. We made the screen in two parts so it could pass through the inspection door. The parts were assembled within the hotwell by bolting. Light cap screws hold the screen in position as shown in sketch. The large screen area prevents any possibility of clogging. Any material collected can be conveniently removed at the next outage of the unit.

J A SWANSON *Princeton, B. C.*

REDUCED OUTSIDE-AIR FLOW CAUSES DUCT TO 'SWEAT'

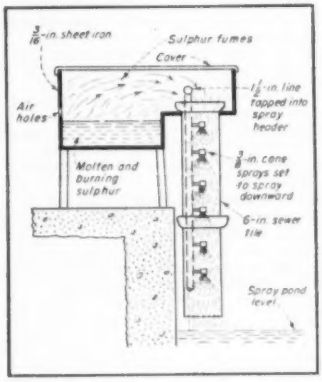


ONE OF OUR air-conditioning ducts suddenly started sweating. Dripping water damaged some valuable stock and we immediately began looking for the cause. We have a mechanical refrigeration system with the evaporator placed as in the sketch. Air circulation uses 75% recirculated air and 25% taken from outside. The trouble appeared after two years of operation.

Obviously the duct-air temperature fell below the dewpoint in the process area. We checked compressor motor speed, condensing-water flow and temperature. Low compressor suction pressure indicated a lower cooling load. We then checked air flow and found the outside air damper had accidentally closed. Loss of the tempering effect caused colder air to enter the evaporator. This resulted in a much lower temperature leaving the evaporator, even though the cooling or refrigerating load was reduced. Opening the damper stopped the sweating immediately.

J D CONSTANCE *Cliffside Park, N.J.*

SULFUR BURNER TREATS SPRAY-POND COOLING WATER



WE HAVE BEEN USING 19-deg Baumé sulfuric acid in 200-lb carboys to keep alkalinity down in our power-plant spray pond. To cut costs for treatment and avoid the hazard of handling large amounts of raw acid I built the sulfur burner in the sketch.

We have an open spray pond, which ruled out sulfur burning as ordinarily practiced with mechanical-draft cooling towers. There is no means in the layout of a spray pond that would automatically make it absorb sulfur fumes.

The sulfur burner shown uses a small amount of the spray water to produce an aspirating effect. This draws the air in over the sulfur pot and the sulfur fumes down into the tile conduit. Here the fumes are absorbed by the water droplets. Absorption is practically 100%, hence no sulfur is wasted.

Sulfur is much cheaper than acid, and no additional labor is needed for operation.

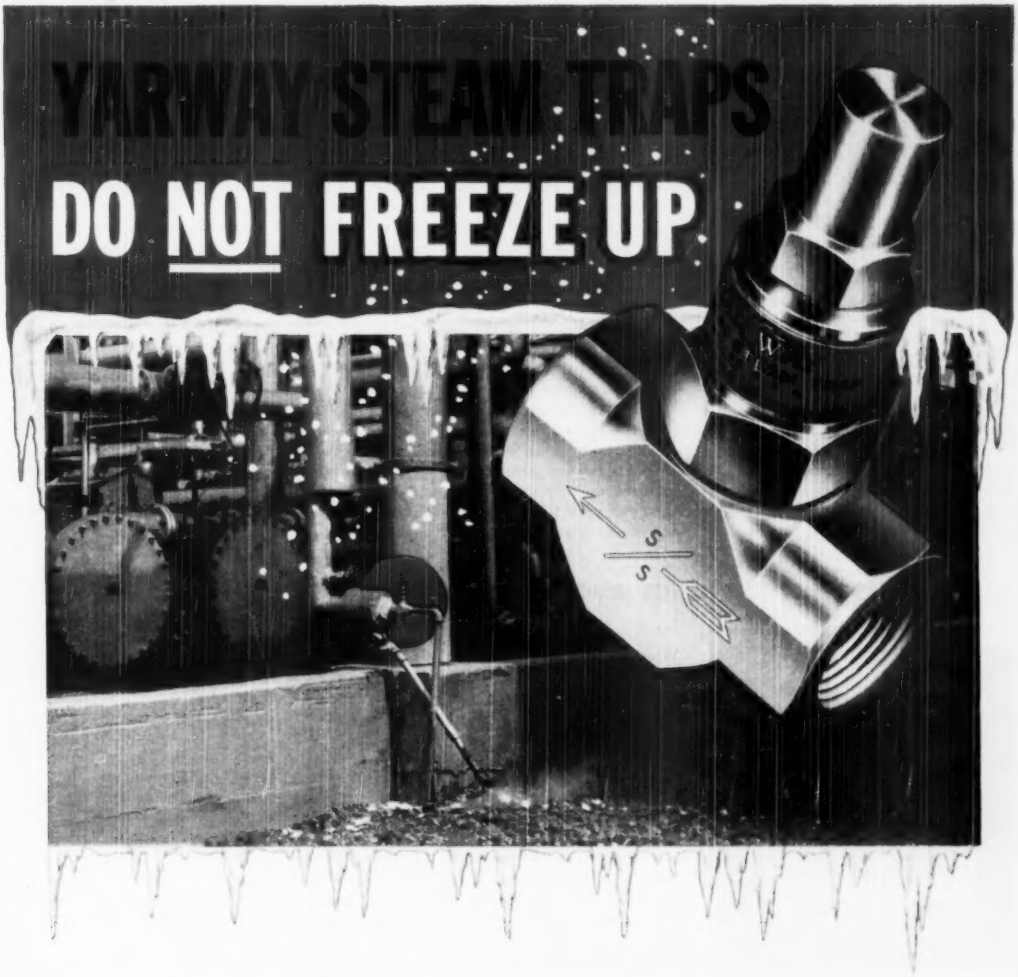
C WEREBITCH *Montgomery, Minn.*

YOUR IDEAS HELP OTHERS

Power readers repeatedly express appreciation for ideas given in this department. Do you have an item to contribute? Your manuscript need give only bare facts with sketches in pencil. We'll dress them up and pay you $20 for each idea accepted.

TURN PAGE FOR MORE PLANT-TESTED IDEAS

YARWAY STEAM TRAPS DO NOT FREEZE UP



What if it is freezing cold—your exposed steam traps won't cause you any worry if they're Yarway.

Yarway Impulse Steam Traps don't freeze because condensate does not accumulate. The only moving part—a little valve—is continually testing for condensate and passing it as soon as it forms. It never waits for a trapful to collect. Hence, there's never anything to freeze.

There are other good reasons, too, why more than 650,000 Yarways have been bought for both indoor and outdoor installations.

They get equipment *hotter, sooner.* They are *small in size, light in weight, easy to install and maintain.* They are *good for all pressures.* Construction is *stainless steel.*

Prove these advantages in your own plant at our expense. Try a Yarway *for free.* Call your nearby Yarway distributor or write direct to . . .

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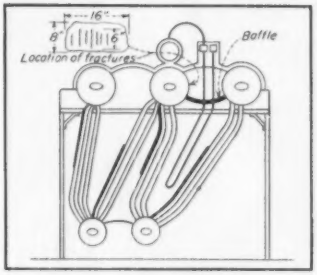
Stainless Steel Body

YARWAY IMPULSE STEAM TRAP

LOCAL COMBUSTION FRACTURES STEAM BOILER'S DRUM



WE HAVE A BATTERY of three boilers designed for 200-psig pressure. Sketch shows their general layout, with the baffle arrangement indicated in heavy lines. They are pulverized-coal fired. A leaking superheater tube forced one boiler out of service. We found the tube had been eroded and corroded by steam impingement. In looking for the source of the steam jet that did the cutting we found the center boiler drum had a bulge. It was in the wrapper plate at about the middle of the drum length and midway between bottom and top rows of circulating tubes, as shown in the sketch. Middle of the bulge had a circumferential fracture about 6 in. long extending through the plate. Magnetic-testing methods showed additional surface fractures within an area of 8x16 in. paralleling the main crack.

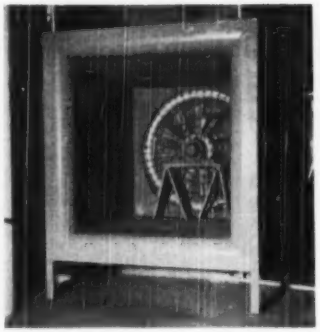
Micro- and macro-examinations of specimens cut from the defective plate showed a normal grain structure. The fractures were of the corrosion-fatigue type. Strength tests of two specimens showed the plate was of good quality.

In view of these facts, we believe the following had happened. Considerable local expansion and contraction took place in the drum-bulge area over a long period. This could have been caused only by intense local heating as borne out by the discoloration of the metal in the bulge. Unburned pulverized coal probably lodged on the upper surface of the adjacent horizontal baffle. This coal burned off intermittently to produce the local heating at the drum surface.

The fracture had developed from the water side. The internal baffle plates in the drum had not been removed for quite some time. This prevented close inspection of the drum interior in the area of the bulge. Moral: inspect inaccessible areas as often as possible.

W A HERRON *Montreal, P. Q.*

SIMPLE ENTRANCE DUCT REDUCES BOILER-FAN NOISE



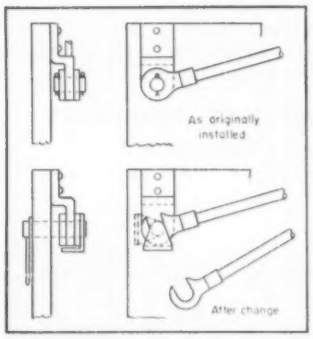
WHEN FIRST RUNNING TESTS on the steam-generating unit in the new municipal plant at Iola, Kan., we found the forced-draft fan made considerable noise. The 1750-rpm speed was responsible for the noise. Since the fan met all specification requirements we had no basis for complaint.

The plant operators felt the fan noise drowned out other operational sounds they would want to hear. So we designed the muffling duct in the photo. The muffler is a 4-ft-long section of square metal duct attached to the fan intake. A 4-in. thickness of 6-lb-density Fiberglas insulating blanket lines the duct. This reduces the noise by about 50%. Increase in friction loss is negligible.

Before building the permanent muffler, a trial model was made of some old ¾-in. plywood, which had been used for concrete forms. This muffler was about the same size as the permanent one. It was lined with excelsior held in place by burlap tacked to the wood. Various vane arrangements were tried in the model to eliminate turbulence. None helped to further reduce the noise. So the simple flared opening was used in the permanent muffler.

E A COOPER *Iola, Kan.*

SAFETY FEATURE OPENS AUTOMATIC DOORS MANUALLY



WE RECENTLY INSTALLED TWO automatic doors in a room where 50 girls work. The doors open by breaking a light beam, which actuates a solenoid-operated valve. This valve admits and exhausts air to the cylinder and piston operating the doors. After one power failure we found the doors were inoperative. We realized that in case of fire results would be disastrous. The sketches show the slight change made to permit manual operation of the doors in an emergency.

The upper ones show the original design. The doors are moved by a clevis on the end of the actuating rod. The clevis is attached to the door by a bracket and pin, see the upper sketch.

Lower sketches show the connection after the change. The original clevis is cut away at the top. The original pin is replaced by a longer pin passing through the door. To one end of the pin an angle is brazed, which acts as support for the opened clevis. On the opposite end of the pin a small handle helps turn the pin from the opposite side of the door. This makes the angle turn, as shown dotted, and the clevis falls away from the pin. By breaking this connection the door can be slid open manually without trying to work against the cylinder and piston.

L KASPER *Philadelphia, Pa.*

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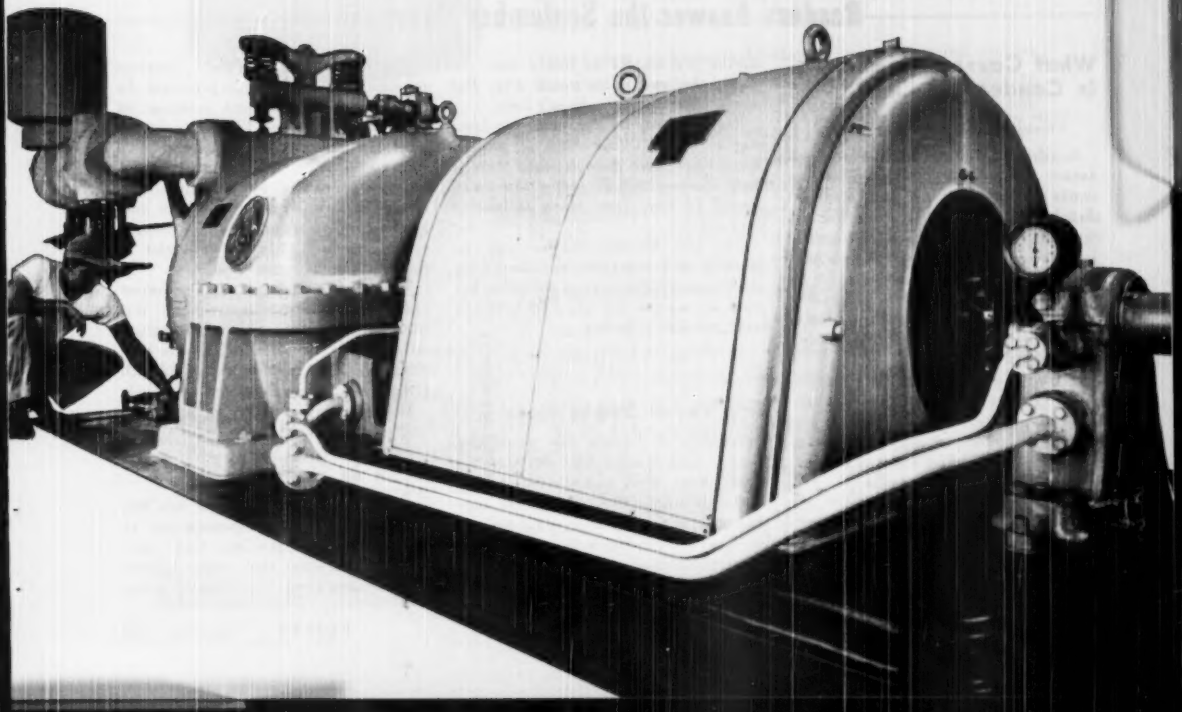
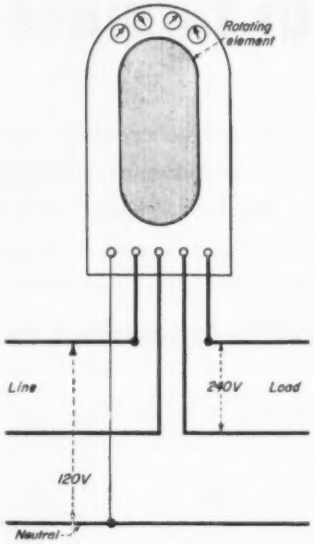
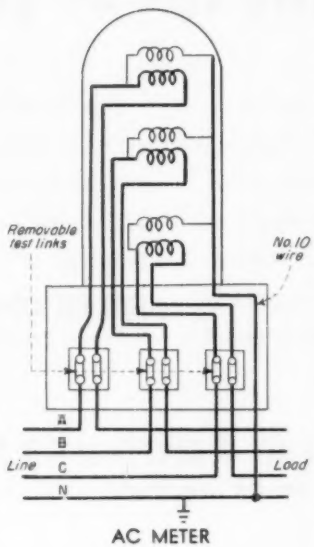


PROBLEMS FROM THE PLANT

THIS MONTH'S QUESTION: HOW CAN WE CHECK AC, DC WHR METERS?



DC METER



AC METER

WE HAVE both ac and dc motors in our industrial plant. These motors drive fans, pumps, heaters, etc. Several years ago we installed watthour meters for each department so we could properly bill them for current used. We generate our own current, both ac and dc in our combined steam and diesel power plant.

Recently we've received complaints from several departments saying their bills are too high. They say meters are no longer accurate and demand they be tested. Sketches show typical hook-ups for 120-208 v ac, 120-240 v dc.

So here's our problem. Is there any fast means for checking accuracy of ac and dc watthour meters? Can checking be done without taking meter off panel? What instruments are needed and how should they be hooked into circuit? We'd appreciate sketches from POWER readers showing how we can do this job in our plant. We'd like to make all tests without interrupting service.—*JB*

Exercise your engineering wits by answering this question, fresh from the plant. Suitable material will be paid for: answers with sketches or photos receive extra pay.

Readers Answer the September Question

What Causes Hammering In Condensate Line?

(This question from the Sept issue is followed by best answers from readers.)

Condensate level in the surface condenser for our 15,000-kw turbine-generator is controlled by a float valve; see sketch [Sept, p 128]. This valve connects to condensate-pump discharge line and feedwater-pump suction. When feed pump doesn't need condensate it is passed through float valve to surge tank. When condenser needs makeup, valve feeds it from surge tank. Now here's our problem:

During makeup to condenser there is severe water hammer in condensate-pump discharge line. We also get bad hammering during a slight change in vacuum. Besides, float drops to makeup position when vacuum changes.

We've dismantled the valve and checked it for sticking but it works freely. We installed an air chamber on condensate-pump discharge but this didn't stop the hammering. When hammering first started we would move the float a bit and noise would stop. But moving the float now doesn't help.

The only way we can now stop hammer is by throttling valve A, sketch. When open more than one turn there is loud hammering. We know this valve should be wide open when turbine is operating.

Can any POWER *readers give us sketches and methods for eliminating this hammer? Everyone in our plant has tried but no one has come up with the right answer.*—LN

Try These Suggestions

DEFINITELY ESTABLISH that equalizing lines to control-valve float chamber are clear. Next check operation of boiler-feed regulators. They should feed continuously, not cut in at ¼ glass and out at ¾ as is sometimes the case. Also, surge tank should operate. It may be full but valve shut or drain plugged.

Control may be type that operates erratically at high supply pressures. In this case *LN*'s excellent coverage of problem points to too high or suddenly changing pressure, which causes valve to stick closed or slam open. Sudden hammer is caused by interruption or change in flow direction in supply line. Location of air chamber and reduction of hammering when valve outlet is throttled indicates this is so.

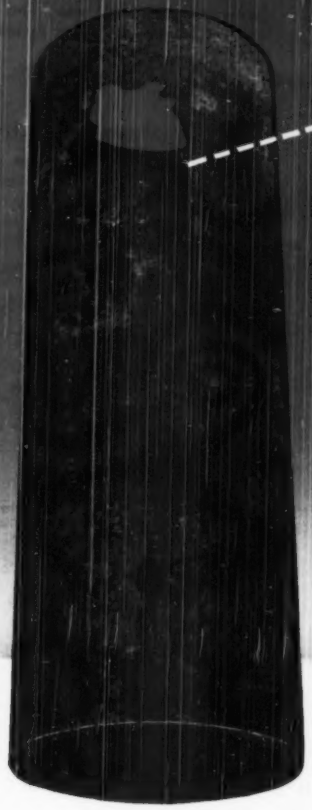
Feed surge tank from some convenient high point in condensate-pump discharge line. Let control valve operate under steady supply and pressure conditions from surge tank only. This will give valve a proper chance to do its job.

W C CAWOOD *Brooklyn, N.Y.*

Flash in Hotwell

FEEDING MAKEUP CONDENSATE into hotwell probably causes hammering in condensate-discharge line. Cool condensate from surge tank enters hotwell where saturation conditions exist.

Prevent Return Line Corrosion



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HERE'S AN exciting *new* development in the Water Conditioning Field!

Corrosion of steam and condensate return lines is a serious problem to most industrial plants. Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new, advanced process for the prevention of return line corrosion employing *octadecylamine*. This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surfaces in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment. Results? As high as *99 percent reduction* in corrosion rate has been achieved!

Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Sts., Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal 1.

Send for Betz Technical Paper 2121, "How Filming Amines Prevent Steam and Return Line Corrosion".

*U. S. PATENT 2,460,259

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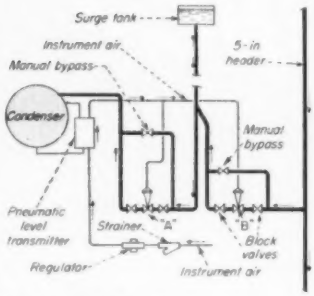
Flashing results. So condensate pumps handle liquid and vapor during makeup to hotwell. That's the cause of *LN's* water hammer. Throttling valve *A* limits hammer by reducing flash.

Remedy by introducing makeup into condensate line before entering a feed heater. A pump is needed for this job. For another method use steam coils in surge tank to raise condensate temperature. Modern plants have surface-type makeup heater to preheat condensate before it's fed to hotwell.

Check air-balance connection. Pressure in it may be slightly higher than in water leg. This prevents true hotwell level from actuating float valve.

RALPH PETTINICCHI
Waterbury, Conn



Valve at Fault

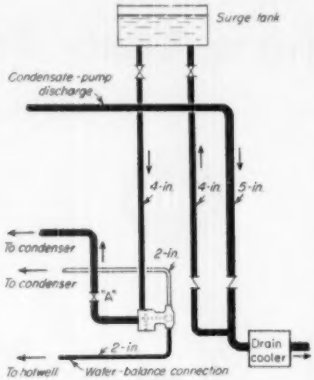
ON BASIS OF EVIDENCE, I believe control valve is at fault. I don't think valve sticks; instead it's badly worn. Operating with an excess of feedwater and with correct condenser level, excess feed goes to surge tank. While in tank its pressure is about same as that at condensate pumps. When condenser water level falls and valve opens, pressure in 4-in. standpipe drops instantly. Somehow closed port connected to condensate header starts to chatter, causing hammer in header.

Cure trouble by either of two means: (1) have a complete factory overhaul of defective feed valve. After overhaul it would probably work satisfactorily. (2) Replace existing float valve with a pneumatic liquid-level transmitter and two diaphragm-operated control valves. See sketch.

Diaphragm valves *A* and *B* are set with valve *A* direct-operating and *B* indirect so *B* will be closed when *A* is open and vice versa.

Trouble in this system is caused by present valve having to operate under widely varying conditions. Setup suggested furnishes a more rugged and sensitive system. Wide range of settings for both valves is obtainable.

A M PALMER *Brooklyn, N.Y.*



Change Piping

SUDDEN CHANGES in pressure with accompanying flash and velocity variation must be avoided to prevent hammer. *LN's* piping arrangement permits condensate-line pressure to act on condenser vacuum. Flow from surge tank is insufficient to prevent sudden pressure drop in condensate line. Flashing occurs, flow increases appreciably with resulting water hammer. Throttling valve *A* prevents these conditions.

Don't feed condensate to surge tank through float valve. Use a separate 4-in. line as in sketch. With this hookup pressure in condensate line is not affected during makeup, and hammer will not occur.

W H FRASER *Elizabeth, N.J.*

Lower Makeup Level

THIS PROBLEM is similar to one in a plant I operated. Water level in hotwell was controlled by a float valve and a recirculating line taken off condensate line just past the i&a condenser. Condensate temperature was increased several degrees in i&a condenser. We had considerable hammer when water flowed into condenser. I believe hammer was caused by part of water flashing into steam when it entered condenser.

Bring makeup into condenser below hotwell water level. This might eliminate hammer.

E W MCKNIGHT *Chapel Hill, N.C.*

Relocate Surge Tank

BRING SURGE TANK DOWN to condenser water level. Its elevation causes a pressure on float valve. Pressure differential causes valve to chatter when float tries to open it. Symptoms *LN* describes indicate to me that a positive-type float valve is used. Change to a balanced-type, and hammer will stop. Remove all slack in float linkage.

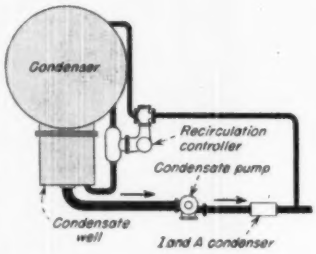
If *LN* doesn't want to put in a new valve he can eliminate hammer in another way. Cut two 1/16 x 1/16-in. grooves across disk seat. This allows a little leakage and gives a cushioning effect like a balanced valve.

HENRY R CARR *Buffalo, N.Y.*

Use Diaphragm Control

INSTALL DIAPHRAGM-CONTROL valve ahead of float valve. This prevents pressure variation across float valve and reduces hammer. Diaphragm valve should have spring adjustment to regulate for constant-pressure differential across float valve. Water flow will then be proportional to float valve opening, and hammer will stop.

A RODRIGUEZ U *Mexico City, Mex.*



Valve Unsuitable

FEED VALVE size and type may be wrong for type of hotwell in this condenser. *LN's* sketch indicates condensate is stored in condenser shell. With this method of storage change in water level is rather slow.

I assume this is a 4-in. spherically-seated unbalanced-type valve. With this type slowly changing condensate level results in operation with valve only slightly off its seat for comparatively long periods of time. There is a high-pressure variation across valve that causes hunting. Rapid pressure changes and hammer occur in condensate-pump discharge line. Hammering from vacuum changes is caused by variations in condensate level.

Use a 2-in. double-seated V-port valve to correct hammer. Simplest way to control condensate level is to bypass part of condensate to condenser as in sketch. When condensate level drops, the float-operated valve opens to allow recirculation. Note that recirculation connection is placed after i&a condenser to assure adequate supply of cooling water at all times.

W H CHENAULT *Atlanta, Ga.*

(*Continued on page* 210)

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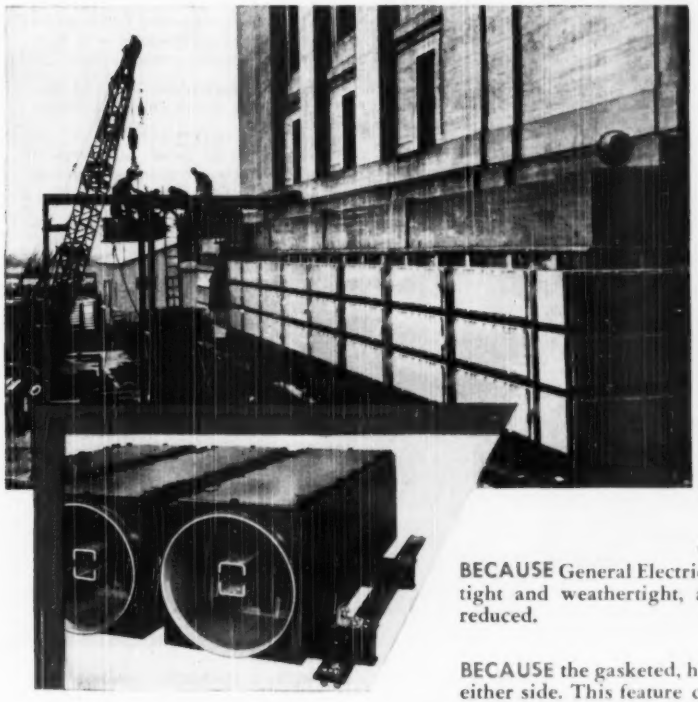

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REVIEWED IN THIS ISSUE

ELECTRICITY: Trends in Auxiliary-Motor Applications in Steam-Electric Stations • Large Tube-Type Totally Enclosed Fan-Cooled Motors • Induced Currents in High-Capacity Bus Enclosures • Centralized Control Board for Steam-Generating Plants

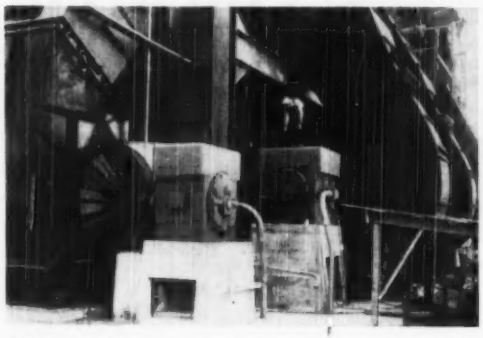
VALVES, PIPING: Joints for High-Pressure High-Temperature Piping • Ultrasonic Flow Detection in Pipes by Means of Their Waves • Flow of Flashing Mixture of Water and Steam Through Valves, Pipes • Steam Lift in Hot-Process Water Softener

INSTRUMENTS, CONTROLS: Trends in Modern Boiler Control • Ultrasonic Method for Measuring Water Flow • High-Speed Supervision of Process Variables • Instruments for Detection of Toxic and Explosive Gases • A Direct-Recording Technique for Pressure Cycles • The Control Valve in Operation • A Non-Mathematical Discussion of Flow Measurement

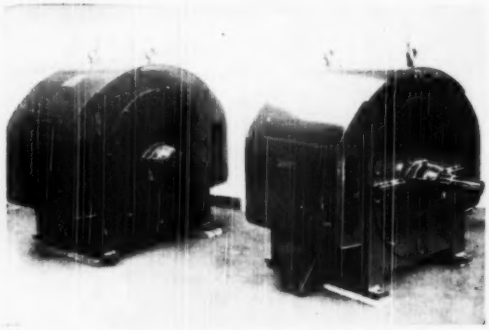
GAS TURBINES: Convenient Gas Properties and Charts for Gas-Turbine Calculations • Combined Steam and Gas-Turbine Processes and Applications

STEAM GENERATION: Investigation of Steam Separation in Boiler Drums • Trend of Power-Plant Practice in Germany • The Use of Tungsten Carbide in Coal Pulverizers

Directions for ordering papers are given on page 136



1 Many outdoor or semioutdoor power plants are going up all over the country. They need a special "ventilated" motor



2 Since 1949 manufacturers have offered special enclosed motors for outdoors in same price range as splashproof units

Electricity

TRENDS IN AUXILIARY-MOTOR APPLICATIONS IN STEAM-ELECTRIC STATIONS, *by H L Lowe, Ebasco Services, Inc.* Increasing costs of building materials and labor make it desirable or necessary to consider installation of more and more electrical and mechanical equipment of steam-electric stations in outdoor or semi-outdoor locations. There is still a further tendency to avoid use of certain building materials like brick and tile because they require such large amounts of hand labor.

Motors selected for these various outdoor applications have generally been splashproof or totally enclosed. Choice depends on factors such as relative cost, importance of operating reliability, exposure to flyash, coal dust, chemical fumes, climatic conditions and rating of motor required. Totally enclosed fan-cooled motors of large size have been used for outdoor installation in a few cases but applications of totally enclosed types have been limited to 50 hp or less for reasons discussed in this paper.

Before 1949 conventional splashproof motors had usually been modified in the field to make them suitable for exposure to outdoor conditions. Since early 1949 manufacturers have offered improved "ventilated-type" motors for this service, Fig. 1, 2, at prices in the same range as conventional splashproof designs. These motors have moisture-resistant winding insulation, better weather protection of ventilating openings, other features designed to meet requirements of outdoor service.

Author presents graphs showing relative costs of motors with various enclosures. The economic basis for choice of motor-supply voltages is discussed. Further improvements are suggested, including larger weatherproof terminal boxes. *AIEE paper No. 50-229.*

LARGE TUBE-TYPE TOTALLY ENCLOSED FAN-COOLED MOTORS, *by R C Moore, Allis-Chalmers Mfg Co.* Operating economies can be had from the use of totally enclosed, fan-cooled motors. By definition, such a unit is a totally enclosed machine equipped for exterior cooling by a fan or fans, integral with the machine but external to the enclosing parts.

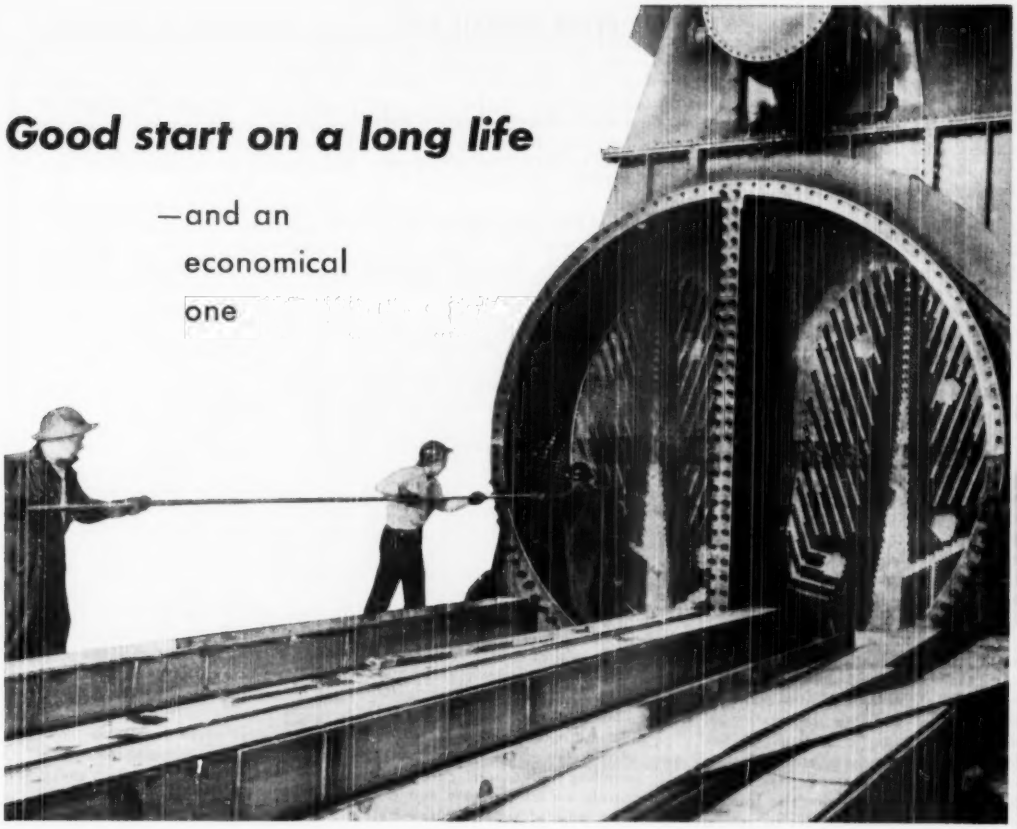
A motor can be enclosed in many ways so weather and dirt do not come in contact with its active parts. When the enclosure is designed the problem becomes one of removing the heat produced by the motor losses. Removal of heat by air to watertube heat exchangers has been common practice for years. Where the use of air only as a cooling medium is preferred, the totally enclosed, fan-cooled motor with cooling tubes built into the frame finds wide application.

Air inside the motor must circulate constantly through the system of motor and cooler in series to provide continuous air flow over the outer surfaces of the tubes. Air circulation inside the motor is obtained by methods often used on open-type machines. When the direction of motor-shaft rotation is known, internal fans on each end of the rotor are often the axial-flow type. If the motor must be suitable for either rotation, use radial-blade centrifugal fans.

For more briefs, turn page

Good start on a long life

—and an
economical
one



This picture shows one of two new Worthington Condensers installed in the Dunkirk Station of the Niagara Mohawk Power Corp. Each contains 7,868 ⅝ in. O.D. x 28 ft. ANACONDA Arsenical Admiralty 439 Condenser Tubes, is rated at 50,000 sq. ft. single pass, and will serve an 80,000 kw. unit designed for 100,000 kw. maximum capacity.

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condenser tubes

Whichever fan is used, however, it is essential that the internal air be constrained to flow through two parallel paths. The air through one path flows through the rotor and stator vent ducts to cool the central portion of the motor while the air through the other path cools the stator-coil ends and rotor end parts. *AIEE paper No. 50-228.*

INDUCED CURRENTS IN HIGH-CAPACITY BUS ENCLOSURES, *by S C Killian, Delta-Star Electric Co.* In recent years, air-insulated high-capacity buses have come into wide use in central stations for connecting generator, high-tension transformer and switchgear. They are now built in a wide variety of designs, metal-enclosed to provide a ground between live conductor and station personnel and most often have interphase barriers to prevent phase-to-phase faults. Each has features to recommend it when considered from economic, mechanical, structural or electrical viewpoint. The electrical problem, much less evident than the others, centers about the enclosure rather than the conductor and involves the question of circulating currents in the enclosure.

These currents may be allowed to flow as in the unsegregated-phase enclosure and the segregated-phase enclosure where they heat the enclosure but protect adjacent building steel from inductive and magnetic heating. In the isolated-phase enclosure these enclosure circuits cannot flow between phases. The individual phase ducts are also broken into sections by insulating strips, which further reduce these currents. Heating in these enclosures will be small, but adjacent steel will not be protected from inductive and magnetic heating. Other external means must then be used to keep the temperature of this steel at reasonable values.

Where circulating currents flow within the enclosure a careful choice of enclosure material must be made. This material largely determines losses in the enclosure and voltage drop in the main bus. This paper discusses this class of enclosure. *AIEE paper No. 50-222.*

CENTRALIZED CONTROL BOARD FOR STEAM-GENERATING PLANTS, *by H L Lowe, Ebasco Services, Inc, and R L Hodgkins, General Electric Co.* Centralization of boiler-turbine and electrical control functions has been a subject of considerable attention for at least a decade. What happens is basically a grouping of several conventional boards formerly placed at scattered locations.

The new Morgan Creek Plant for Texas Electric Service Co has a new approach for centralized control of all combustion, steam and electric power facilities. Of greatest importance is the opportunity afforded one man to have a comprehensive knowledge of the entire plant performance. Further, that one man has complete control over all important operating functions. Both these heavy advantages have been accomplished in a control room with an area 50% smaller than conventional, using control panels with greatly reduced linear footage.

This result came about in several ways. Among the more important were: (1) including only those indications and controls needed for easy and efficient adjustment of boiler, turbine and generator auxiliaries in normal and emergency operation (2) selecting all front-of-panel instruments, gages and controls to the smallest size consistent with good readability and accuracy (3) choosing a duplex-type benchboard, which conserves space, permits mounting recording instruments, watthour meters, relays, automatic station oscillographs on the older panels. *AIEE paper No. 50-223.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources unless otherwise noted:

American Institute of Electrical Engineers, fall Midwest meeting, Oklahoma City, Okla. Oct 23-27, 1950. *Obtainable through AIEE, 29 W 39th St, New York 29, N. Y.*

American Society of Mechanical Engineers fall meeting, Worcester, Mass. Sept 19-21, 1950. *Obtainable through ASME, 29 W 39th St, New York* 29, *N. Y.*

Instrument Society of America and the Instrument Div, ASME, annual meeting. Buffalo, Sept 18-22, 1950. *Obtainable through ASME, 29 W. 39th St, New York* 29, *N. Y., or the ISA,* 921 *Ridge Ave, Pittsburgh* 12, *Pa.*

Valves, Piping

JOINTS FOR HIGH-PRESSURE HIGH-TEMPERATURE PIPING, *by I H Carlson, W S Black, Crane Co.* Leaks in pipe joints have long troubled operating engineers. As a direct result welding has been used whenever possible. Some experts feel that welding piping of different expansion characteristics is not too sound. But mechanical joints are always necessary where piping must be disconnected from the equipment it serves.

One big problem such a joint faces is stress from temperature. This stress is often several times that permitted by code formulas, which are based on pressure alone. Further, these formulas do not yet include factors to indicate extent of stresses created by differential expansion. As an example, a temperature difference of only 150 F between two points in a steel mass may produce a stress of 30,000 psi.

For these reasons a series of joints has been considered that will permit relative motion between two parts of the joint having differences in expansion due either to variation in operating temperatures or coefficients of expansion. Paper includes results of an extensive test on three full-sized joints for 1900-psi 1050-F steam service for connecting austenitic alloy turbine equipment of 150,000-kw capacity.

Scope of the tests was limited by amount of steam available. Joints were covered in such a way that leakage, if any, would be conducted to a one-inch drain pipe where an electric thermoswitch or condensation on a piece of glass would detect it. *ASME paper No. 50-F-32.*

ULTRASONIC FLOW DETECTION IN PIPES BY MEANS OF THEIR WAVES, *by C D Moriarty, General Electric Co.* Annular cross-section of a pipe does not lend itself to adequate inspection for flaws by normal ultrasonic methods. This is especially true where radial-type flows extending axially are suspected. This type flow is usually greater in a radial than a circumferential direction. Need for an ultrasonic way of testing such flows is evident when you consider that under internal pressure the pipe would weaken.

Three major methods or waves can be used: longitudinal, at present in most common routine use; shear, just recently applied to inspection problems; surface, not yet applied as far as the author knows.

He describes the different types of equipment used, defines the different wave forms, explains various preparation steps to ready pipe for testing by the techniques. Some basic information by which the entire method of ultrasonic testing can be evaluated is also advanced.

This testing method is still relatively new. Successful experience, to date, indicates it has strong possibilities for future use. *ASME paper No. 50-F-14.*

FLOW OF A FLASHING MIXTURE OF WATER AND STEAM THROUGH VALVES AND PIPES, *by W F Allen, Jr, Stone & Webster Engrg Corp.* Designing piping like the cascade drain lines between feedwater heaters has always been difficult. Reason is the behavior of what

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Mr. Insulation says:

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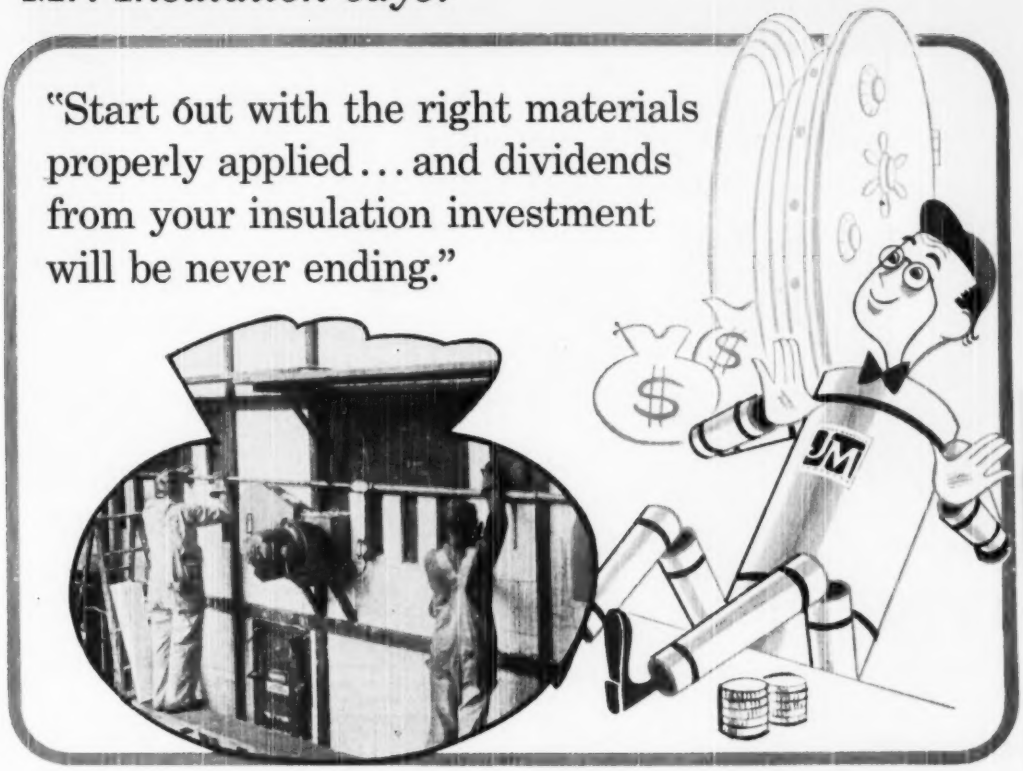

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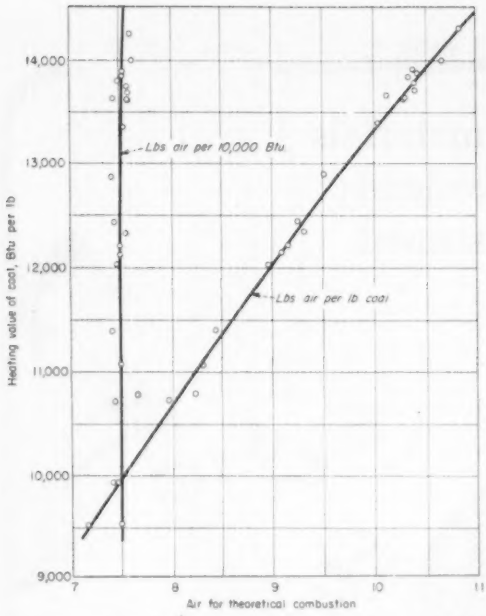
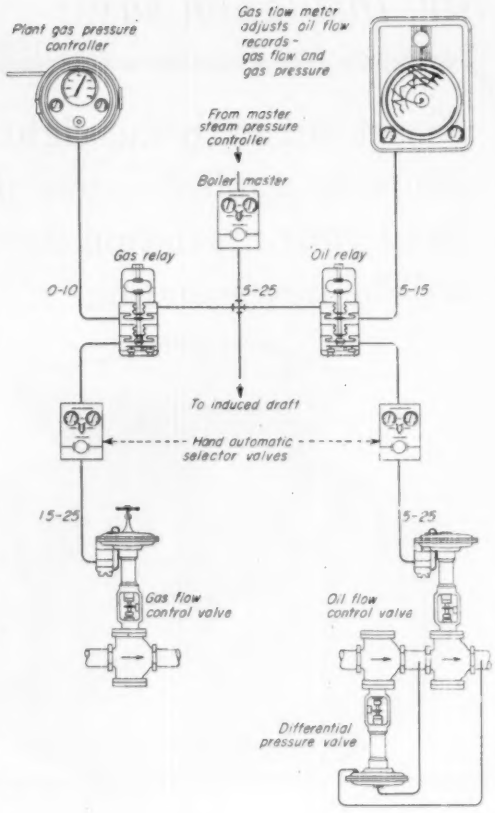


3 Theoretical pounds of air, per pound fuel and per 10,000 Btu liberated, give different curves, one steady, one not



4 Control arrangement permits firing of two different fuels, particularly where the gas availability is mostly periodic

starts out to be a saturated liquid from a source at one pressure as it nears a receiver at a lower pressure. Experience proves that sizing of valves and piping by usual criteria is unsatisfactory. The alternate method, sizing by empirical formulas or arbitrary selection, is costly and gives no guarantee that the resultant piping capacity will be adequate.

This paper presents simple, rational formulas that can be used in piping and valve design with the assurance that resultant capacity will be adequate. Formulas have been worked up from energy, continuity and dynamic equations on the basis of an assured uniform mixture at any point in the flow path.

Earlier papers have predicted and experimentally verified existence of a critical pressure under certain conditions at the end of a pipe carrying a flashing mixture. Results calculated from the derived formulas compare favorably with these published test data.

If the initial assumption of a uniform mixture is not fulfilled, limitations imposed on the piping are less severe because both valve and pipe capacity are greater for the new conditions than the formulas required. A scheme is also suggested for eliminating flashing completely in heater drain systems using drain coolers. *ASME paper No. 50-F-27.*

THE STEAM LIFT IN A HOT-PROCESS WATER SOFTENER, *by A A Kalinske and J M Kahn, Infilco, Inc.* Feedwater treatment is so complicated and involved that a considerable amount of specialized equipment has been developed. A lot of the reason for this development has been increased operating steam pressures with the need for very-high-quality feedwater.

In many instances the first step to complete water treatment is softening water with lime and soda ash at elevated temperatures. Functions of a primary hot-process water softener are: (1) Intimately mix chemicals, such as lime and soda ash, with incoming raw water. (2) Flocculate and condition resulting precipitates. (3) Separate resulting precipitates from treated water so suspended solids may be at a minimum. (4) Settle and thicken the precipitates for easy economical removal. (5) Deaerate water to reduce dissolved oxygen content. (6) Remove dissolved silica. Except for deaeration this is just about what a cold-process softener does.

To obtain the intimate mixture of chemicals in (1), *above*, various mechanical agitators, pumps and similar devices have been used. A possible way of doing this without mechanical pumping or agitating equipment is to use a steam lift. The air lift has long been used for cold-water handling and those same principles can be used for predicting steam-lift performance.

Author shows several softeners equipped with a steam lift, gives a theoretical analysis of what goes on, cites some operating results. *ASME paper No. 50-F-29.*

(*Continued on page* 160)

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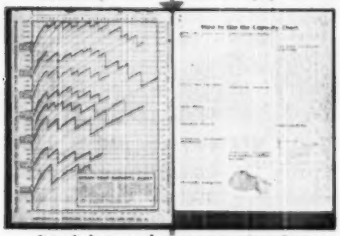
How to calculate condensate loads and select traps for all classes of equipment.



Actual hot condensate capacity chart for every Armstrong trap, recommended safety factors and specific recommendations for many types of equipment.

THERE is no guess work about steam traps or steam trap selection when you have the 36-page Armstrong Steam Trap Book to work with. You don't waste money on traps that are too big for the job. You don't get inefficient drainage with traps that are too small.

This book explains the design, operation and advantages of Armstrong steam traps, specifies materials used, gives complete dimensional data, includes list prices, actual capacities under working conditions. There are 10 pages of tabular and technical data explaining how to calculate condensate loads and select the correct trap for the job, complete instructions on installation and maintenance. The Steam Trap Book also describes Armstrong traps for draining moisture from compressed air systems, Armstrong steam humidifiers for adding moisture to dry air and Armstrong non-condensable gas purgers for removing air from refrigeration systems.

Anyone is welcome to a copy of this useful guide to good trapping practice. Send for yours today.

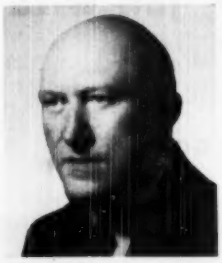
ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Mich.

ARMSTRONG STEAM TRAPS

J CALVIN BROWN, *President*
Mechanical Engineer, Los Angeles, Calif.

The ASME Elects Its New Officers

REGIONAL VICE-PRESIDENTS



HARRY R KESSLER

STEPHEN D MOXLEY

J T RETTALIATA

CARL JOHN ECKHARDT

DIRECTORS-AT-LARGE

HAROLD E MARTIN

LIONEL J CUCULLU

► AT THE CONCLUSION of the annual meeting of the American Society of Mechanical Engineers in New York City, Nov 27 - Dec 2, the candidates selected by the nominating committee in St. Louis, June 19-23, and voted on by mail ballot by the membership, take over their respective offices.

The new president, J Calvin Brown of Los Angeles, Calif., is both a mechanical engineer and an attorney, a graduate of California Institute of Technology and Hamilton College. He specializes in patent, trademark and copyright litigation before the United States courts. His membership in ASME dates to 1928.

For a number of years Brown has been very active in the Southern California Section and lately in the national organization serving as manager of the ASME in 1943-44, and vice-president, 1945-47 and 1947-49.

Regional Vice-Presidents. Harry R Kessler, of New York, Region II; Stephen D Moxley, Birmingham, Ala., Region IV; J T Rettaliata, Chicago, Region VI; Carl John Eckhardt, Austin, Texas, Region VIII have been selected as vice-presidents for 2-year terms to represent their regions.

Kessler, a Stevens Institute graduate and New York manager for Republic

(*Continued on page* 214)

From routine water treatment reports and water sample analyses, experts at Nalco Laboratories keep a complete record of your plant water treatment — can assist materially in maintaining permanent water treatment security.

How a *Nalco* WATER TREATMENT SERVICE AGREEMENT WORKS FOR YOU

OPERATION of your plant under a Nalco Water Treatment Service Agreement gives you two important safeguards against water treating problems in any form. First, Nalco will provide proper water treatment chemicals and procedures. Second, an experienced Nalco Service Representative will make regular visits to your plant, and is on call at any time to deal promptly with emergencies. Whether you have 10 or 10,000 BHP, this combination will provide what thousands of Nalco System users have learned to take for granted: *permanent water treatment security.*

Write, now, for full information on a Nalco Service Agreement for your plant.

Nalco

SERVICE AGREEMENT SECURITY FEATURES

- **COMPLETE WATER TREATMENT SURVEY** of your plant by an experienced Nalco representative.
- **LABORATORY ANALYSES** of water samples . . . Initial complete analyses, followed by routine sampling and analyses as checks on plant tests.
- **RECOMMENDATIONS** of chemicals, testing and control procedures to establish water treatment security.
- **REGULAR CALLS** by a Nalco Representative to assure continuously successful treatment.
- **REPORT SYSTEM** to Nalco Laboratories gives cross-check on all phases of the Nalco System; enables keeping of complete performance records on your plant.
- **CONSULTING SERVICE** always available to assist in solving current problems — and in planning changes or additions to your plant which may affect water treatment.

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario, Canada

THE *Nalco* SYSTEM • Serving Industry through Practical Applied Science

TENANT CALLS when set fails, hopeful that trouble may be in master antenna (of course the set is never at fault!). Then Jim sends one of his assistants up with a small portable set

ASST ENGR Greg Kunkel with set he knows is OK. No attempt is made to repair the receiver or master antenna system. Aim is to tell which is at fault. Tenant's set is his responsibility

TV Troubles of a Power Engineer

Chief Engineer James McCulley of New York's Park Lane Hotel has swung over to complete master TV antennas—*Power*, Sept 1950, p 82. Permanent guests, who have their own receivers, call Jim when their sets fail. Here's how he traces trouble to antenna or tenant's set

TV OUTLET plugs are swapped, leaving test set ready in position. If portable set receives, the antenna system is OK

JIM McCULLEY makes it a point to supervise all television trouble calls. His master antenna system has been in service for several years with no real trouble to date. And it eliminated a maze of unsightly roof-top antennas, plus giving good reception

All these Valves . . from One!

Valve combinations for 90% of industrial piping assembled with 4 bodies and a handful of parts.

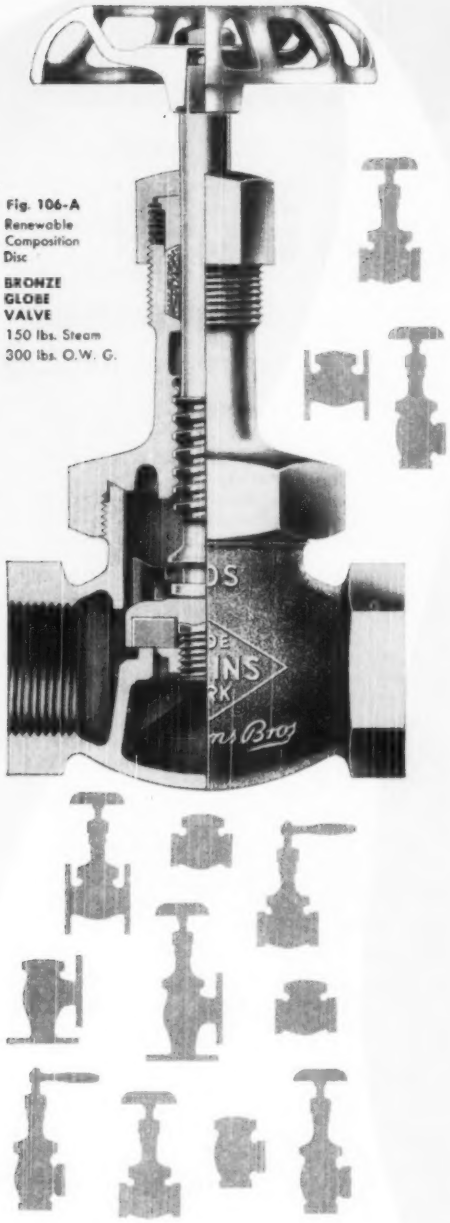


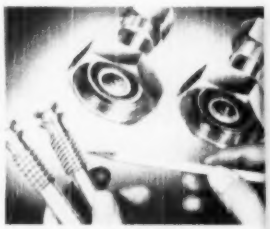
Fig. 106-A
Renewable Composition Disc

BRONZE GLOBE VALVE
150 lbs. Steam
300 lbs. O.W. G.

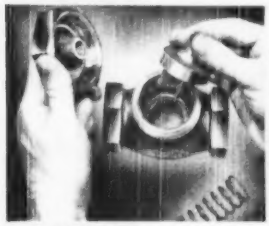
JENKINS FIG. 106-A "FAMILY"

Start with the standard Fig. 106-A. Trimming is interchangeable in Globe or Angle body, screwed or flanged.

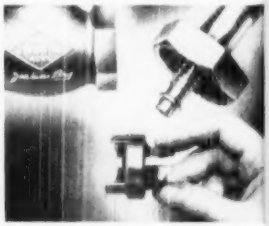
For Close Control — In throttling service, the nut which holds the disc in the disc holder is removed and replaced with Throttling Nut, Fig. 344.



For Quick Opening and Closing — Merely substitute the bonnet and spindle from Fig. 941, in which threads are pitched more sharply.



For Lift Check Service — Globe or Angle Bodies can be fitted with interchangeable Cap, Disc Holder, and Guide Disc Nut from Fig. 117A. Addition of spring from Fig. 655A provides spring loaded service.



For Stop & Check Service — Use the 106A trim, but substitute this spindle from Fig. 650A and replace the regular disc nut with the check valve guide disc nut.

Look over these pictures and see how easy it is to make up just the valve type you need, simply by interchanging parts. Think of the saving this means in maintenance expense . . . in reduced inventory of spare valves in your stockroom.

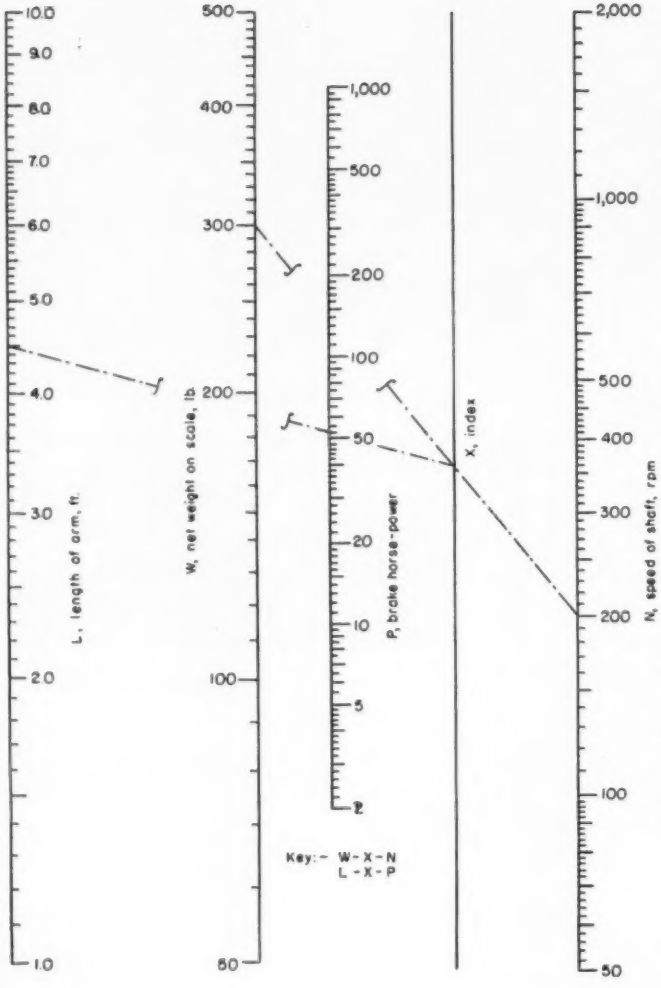
That's a big reason why the Fig. 106-A series takes top honors in any poll for valve preference. And Jenkins time-proved design, makes them the longest-lasting, lowest-upkeep valves that money can buy.

For example, see the heavy construction of the one-piece, screw-over bonnet. You can remove and replace it over and over again without distortion. See the extra size packing box,—and the perfectly machined threads on the heavy manganese bronze spindle, with more threads in contact with the bonnet, open or closed.

Remember, Jenkins Bros. is the originator of the renewable composition disc valve,—the *only* manufacturer of both valves *and* discs. For drop-tight, trouble-free performance, get acquainted with the Fig. 106-A "family". Despite their extra value, *you pay no more* for Jenkins Valves. Jenkins Bros., 100 Park Ave., New York 17, N. Y. Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES

Figuring Horsepower by Prony Brake



► PRONY BRAKES are one of the methods most commonly used for testing and measuring the power outputs of prime movers. Formula for figuring brake horsepower depends on dimensions of the brake and engine speed:

$$\text{Brake hp} = \frac{2\pi WLN}{33{,}000}$$

where W = weight on brake scale, lb
L = length of brake arm, ft
N = engine shaft speed, rpm

Length of brake arm must be measured from center of engine shaft to point of contact of brake arm with scale platform. The weight W must be the net weight that eliminates weight of the brake arm.

To use the nomogram for figuring horsepowers, follow the key. Let's try the chart out with an example.

Example: A prony brake with an arm 4½ ft long has a zero or tare weight of 12 lb. When applied to an engine turning at 200 rpm it balances a total weight of 312 lb on the scale. Find the engine output.

The net weight is 312 − 12 = 300 lb. On the W scale lay a straightedge from 300 to intersect with 200 on the N scale. Find the intersection with the X scale. From here lay the straightedge to cross 4.5 ft on the L scale. Read the answer 51.5 hp at the intersection with the P scale.

JOHN F HYMAN, *Sarnia, Ont.*

COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

Boiler Feed Water Control . . .

Fully-automatic continuous COPES feed means safe, economical boiler operation. Choose from three basic control systems:

1. **SIMPLE LEVEL CONTROL** —one control influence
2. **FLOWMATIC CONTROL** —two control influences
3. **BALANCED FLOW CONTROL** —three control influences

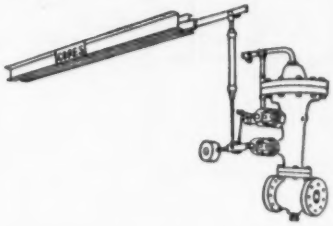
1 SIMPLE LEVEL CONTROL

Feeds in response to drum water level changes. For moderate pressures and ratings. Type BI (*Leaflet P-1-D*) is standard. Type OT (*Leaflet P-2-A*) is the adaptation for small boilers.

PUMP GOVERNORS

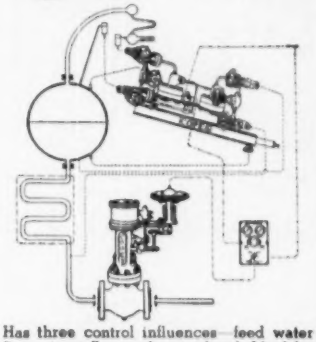
For excess pressure service in boiler feeding. Special types for motor, or turbine-driven, centrifugal or reciprocating pumps. Master control available, where needed. Each unit designed for accuracy over a long service life under adverse conditions. Easily maintained. *Write for data, outlining your needs.*

2 COPES FLOWMATIC



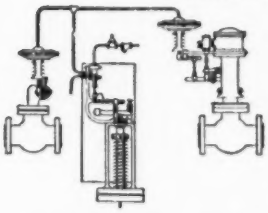
Simplest, most widely used flow-level type feed water regulator; more than 3400 boilers equipped. Feeds according to steam flow and water level to control level closely on fast-steaming generators, on any boilers taking rapid load swings. Easily adjusted and maintained by boiler room personnel. Direct-operated Type D-O, *see Bulletin 429-B.* Relay-operated Type R-O and air-operated Type A-O, *see Bulletin 441.*

3 BALANCED FLOW



Has three control influences—feed water flow, steam flow and water level. Ideal for the ultra-modern high duty steam generators. Independent of other boiler instruments and controls; will remain on full-automatic when they are out of service for routine servicing. Can control through hydraulic couplings. *Leaflet P-25.*

PRESSURE REDUCING VALVES



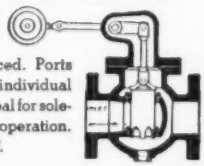
Built for jobs too tough for ordinary stock valves. Each is individually designed for your specific needs, with accuracy and dependability guaranteed. Quiet in operation. Direct or relay operation —with master control if desired. Pressure drops up to 2500 psi. Sizes to 14-inch. *Bulletin 477.*

DESUPERHEATERS

As accurate on light flows as on maximum loads. Complete atomization of cooling water over full range of operation, because flow is controlled at point of dispersion, not by any outside valve. Easy maintenance. Complete unit self contained. *Bulletin 405-B.*

BALANCED VALVES

Practically frictionless, closely balanced. Ports designed for individual installation. Ideal for solenoid or float operation. *Leaflet P-3-B.*



BOILER STEAM TEMPERATURE CONTROL

Holds uniform steam temperature under all load conditions. Sprays water into steam through variable-orifice nozzle between superheater stages, according to outlet steam temperature and rate of flow. Designs for boilers with heat exchangers. *Write for data, outlining your conditions.*

LIQUID LEVEL CONTROLS

For open or closed vessels. Improved float chambers or flange-type floats, with mechanical or fluid connection to COPES balanced valves. Pressures to 400 psig. *Write for details.*

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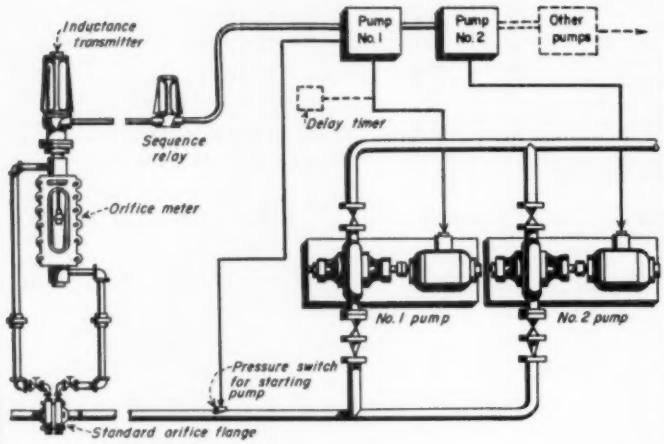


AUTOMATIC PUMP-SEQUENCE CONTROL P1201

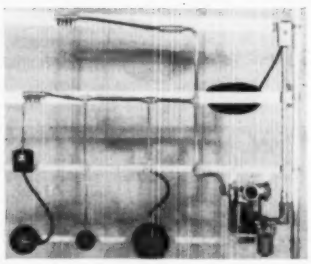
This sequence-control system starts and stops pumps automatically according to demand in petroleum-fuel-loading terminals and similar setups. Its two parts are: an accurate meter and a contacting element. Meter is a new application of the orifice or differential principle.

A small part of main flow passes through the meter lead lines, directly proportional to main flow. Orifice meter indicates this bypass rate, calibrated in main-line flows.

The one moving part of meter, the float, is a stainless-steel disk with a thin nickel-alloy rod that extends up into a closed top above the meter, to actuate the contacting elements. In this closed top are flat coils at pump cut-in points. The impedance changes as the nickel rod passes through each coil and is picked up by a simple electronic circuit to start the proper pump motor. Coil positions are easily changed in the field to adjust pump-starting sequence.

Operator can manually control the first pump and have all other pumps start automatically to meet the demand. Or, a pressure switch can be used to start the first pump on loss of pressure. After this the sequence control can start and stop the other pumps according to flow needs. Bulletin 10161 available.

Fischer & Porter Co, Hatboro, Pa.



OIL-MIST LUBRICATION P1241

System of constant and automatic delivery of lube oil to machine bearings in "air-borne" microscopic particles through tubing. Immediate effects are reduction in bearing temperatures, permitting increased machine speeds; prevention of product spoilage by total elimination of dripping: elimination of machine downtime for lubrication. Non-dripping feature makes system well adapted for textile and food plants.

With the *Oil-Mist* system a fresh, constantly replenished supply of lubrication is present as long as the machine is running. The lubricator, attached to each machine, is slightly smaller than that in the conventional oil filter on the passenger automobile. Only two controls are used. One control is a built-in air-pressure regulator. The second is a needle type valve that controls the oil flow. Clean dry air is supplied through a new self-emptying water separator which is part of the lubricator. Maximum air consumption is about 1 cfm. Units are used with regular compressed air line.

Alemite Div of Borg-Warner Corp, 1826 Diversey Pkw'y, Chicago 14, Ill.

SMOKE DETECTOR P1221

Photoelectric smoke detector for air-conditioning duct system has sensitive photoelectric circuit with fail-safe design plus tamperproof sensitivity to prevent an authorized adjustment. A Photoswitch smoke detector Type A28E and a light source L30R are the major elements.

Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass.

WATER TREATMENT P1219

Foaming and carryover because of high alkalinity, dissolved or suspended solids or any combination of these causes can be held in check by *Concentrol*, a special treatment recently developed.

Surface-active agent polyalkylene glycol group effects rapid change in surface tension of steam bubbles so they coalesce. All bubble films that form are unstable and break down when they reach the steam-releasing surface. *Concentrol* is available in several different formulations, some containing tannins.

Bird-Archer Co, 400 Madison Ave, New York 17, N. Y.

VACUUM GAGES P1205

Redesigned line of thermocouple vacuum gages for industrial and laboratory services. Included are a 115-v portable gage and types for both rack and panel mounting. All but the rack type operate either from 115-v ac or from No. 2 flashlight batteries. Gages may be used in either glass or metal vacuum systems to give a continuous pressure indication.

General Electric Co, 1 River Road, Schenectady, N. Y.

GAS-FIRED HEATER P1206

Entire line of propeller, blower and duct-type gas-fired heaters have been approved by the American Gas Assn. The burner is arranged so flame burns entirely inside the heat exchanger. Secondary air passes into exchanger around the flame and shields sides of exchanger from heat. Internal fins at top of heat exchanger improve heat transfer efficiency.

U.S. Air Conditioning Corp, Como Ave, S.E. at 33rd, Minneapolis 14, Minn.

PRESSURE BLOWERS P1213

Complete blower, designed and constructed as a unit, includes direct-drive motor mounted within hub and housing. Class 2000 blowers are tailormade for any

For further data on above items use reply cards on page 196a, identifying your request with letter P and number

low-cost maintenance?

make it yours
with dependable quality

CRANE VALVES

No. 960 Crane Brass Pressure Regulator for steam or air. Literature on request through your Crane Branch or Crane Wholesaler.

A CASE HISTORY FROM CRANE FILES

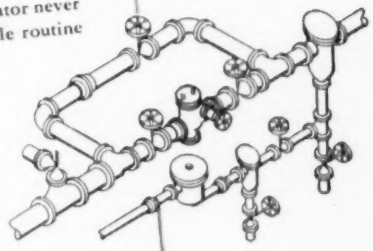
PROBLEM: To choose a pressure regulator that would assure a steady, unvarying steam supply to cooking kettle for an exacting brewing process.

WORKING CONDITIONS: Regulator subject to continuous operation 24 hours per day. Main steam supply at 100 psi to be constantly reduced and maintained at 30 psi.

SOLUTION: Crane No. 960 Brass Pressure Regulator. (*Former model with integral non-renewable cylinder.*)

RESULT: For 16 years, throughout its lifetime, the Crane 960 Regulator never failed, never faltered, never required more than prescribed simple routine servicing.

Replaced with new Model 960 Crane Pressure Regulator. With all wearing parts renewable, it will virtually never wear out. Now in service 18 months; operating cost: zero.



A typical example of the long life and low-cost maintenance that make Crane Quality the best value in all types of valves. That's why... More CRANE VALVES are used than any other make

CRANE

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

one of a number of performance requirements. From standard parts a unit of given diameter with from two to nine blades, set to the proper angle, may be provided. The 2000 units come in two sizes: Series 16, with 16-in. hub, diameters 3 to 5 ft, and Series 24 with 24-in. hub, diameters 4 to 8 ft.
Moore Co, Marceline, Mo.

PANEL INSTRUMENTS P1232

Modernistic design makes these large-scaled instruments easy to read under all lighted conditions. Difference in the 3 models is in size; 4½, 3½ and 2½ in.
Simpson Electric Co, 5200 W Kinzie St, Chicago, Ill.

OIL-FILTER REFILLS P1239

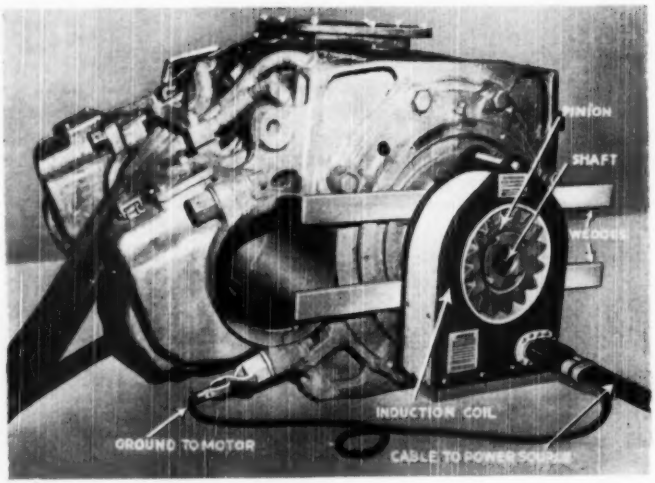
Type S cartridge contains 4½ lb of *Pulconia* tightly packed in woven cotton sock material. Performance of this cartridge is comparable to Type MF, for removal of abrasives, scale, etc. Fiber center tube simplifies disposal of spent cartridge as entire unit is completely consumed by burning.
Honan-Crane Corp, 200 Superior Ave, Lebanon, Ind.

FLUORESCENT LAMP GUIDE P1250

Lok-Gyde slides onto a fluorescent lamp socket with open end toward lamp. Forked arrangement permits sliding the lamp pins in place; the guide then adjusts itself to act as a lock, preventing the lamp from falling out of socket. Device simplifies lamp replacement, as well as preventing accidents.
Edison Electrical Co, 355 Weybosset St, Providence 3, R. I.

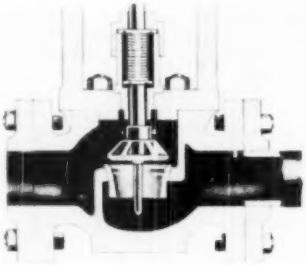
POCKET THERMOMETER P1203

Armored or plain etched-stem glass thermometers for temperature between −30 F and +120 have lightweight non-corroding protective cases for pocket use. *Thermicator* is 6 in. long, ⅜ in. diameter, with scale divisions 2 deg over the instrument range.
Tagliabue Instrument Div, Weston Elec Instrument Corp, Dept 414, 614 Frelinghuysen Ave, Newark 5, N. J.



INDUCTION HEATER FOR PINION REMOVAL P1248

To remove pinion, the induction heater is slipped over gear and electric power applied to its induction coil. Removal usually takes one to two minutes. Device generates heat within the pinion. As a result, the surface is not overheated and the pinion can be removed with but little pressure.
National Electric Coil Co, Columbus 16, Ohio



PACKLESS REDUCING VALVE P1229

Available in both pilot-operated and direct-operated valves, sizes range up to 3 in. Sticking stems are eliminated and added control is given to valves already holding within 1 oz on reduced pressure.
The C E Squires Co, 18502 Syracuse Ave, Cleveland 10, Ohio

PACKAGED BOILER P1222

Completely shop-assembled, integral-furnace type boiler, the FM, is produced in standard sizes for loads ranging from 7000 to 25,000 lb of steam per hr. It is a watertube boiler, with completely water-cooled furnace. Boiler is shipped and delivered as a unit ready to skid or lift in position, hook up and place in operation.
Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y.

STEEL-ENCLOSED BREAKERS P1244

Types *G-25* and *G-50* low-voltage air circuit breakers are now available for individual mounting. Steel enclosure completely surrounds circuit breaker and cable connection. Front portion has a hinged panel, ventilating louvers, latching mechanism and door handle.

These breakers are suitable where frequent operation is expected; protection of lighting loads and small transformers, across-the-line starters, as back-up protection for motor starters, etc. They may also be used as mainline feeder breakers on systems that have an ac voltage of 600 and below.
Allis-Chalmers Mfg Co, Milwaukee, Wis.

VOLTAGE REGULATOR P1243

Redesign of the *MLT 32* step voltage regulators provides 3-phase regulation in 0.63% steps. Range has been increased to include sizes up to 2500 kva, 69 kv.
General Electric Co, Schenectady 5, N. Y.

REFRACTORIES P1220

New super refractory to sell for half usual price in standard firebrick sizes, the *Allmal*, is produced from a base of mullite. Material will not melt until it reaches more than 3300 F, about one third higher than steel's melting point. At 3000 F a firebrick of *Allmal* supports 1000 lb without deforming. When successively heated

For further data on above items use reply cards on page 196a, identifying your request with letter P and number

"Even *the UNUSUAL* can include *the CONVENTIONAL*"—REVERE

ATMOSPHERIC TOWER OVERHEAD CONDENSERS

Each battery of 6 has a total capacity of 60,000,000 BTU/hr with 18,000 square feet of effective surface. Made by Henry Vogt Machine Co., Louisville, Ky. Revere Naval Brass fixed end plates are 38½ in. diameter by 2⅛ in. thick, floating end plates are 35¾ in. diameter by 2 in.

These Henry Vogt Machine Co. condensers have an unusual feature: vapor belts in the shells to feed more copious and uniform flows of vapor than are obtained by the usual single nozzles.

Inside the condensers, the tubes are rolled into Revere Naval Brass Tube Sheets.

The use of Revere Naval Brass for this purpose is completely conventional in condenser building practice. Revere Naval Brass is corrosion resistant, strong, tough, durable. Every mechanic on the production line knows how to fabricate it. Every maintenance man knows how to treat it when doing a servicing job. Thousands of Revere Naval Brass plates are in daily use in condensers and other heat exchangers built by all the best manufacturers. Some of these plates have been in service for decades.

Revere has alloys for your unusual design features too. Some of these are conventional, made to do unusual jobs because the Revere Technical Advisory Service knows where and when to recommend them. Others are less well known.

When you work out an unusual design you want to concentrate your attention on the unusual features. Under those conditions, use the time tested, service proven, utterly dependable standard Revere alloys in the standard parts of your design and you will be able to forget those parts and keep your attention where it is needed.

For any problem at all that involves the use of metals, consult the Revere Technical Advisors. Their knowledge, skill, experience, contacts (yes, we ask questions as well as answer them) can add up to money in the bank for you.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y.

Sales Offices in Principal Cities, Distributors Everywhere.

EQUIPMENT NEWS *CONTINUED*

to 2550 F and sprayed with cold water a dozen times it shows no cracking or chipping.

Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y.

REVERSIBLE PIPE TONGS P1228

Without removing tongs or loosening chain *Vulcan* reversible pipe tongs will turn pipe in either direction. Outer jaws are removable to make a fittings tongs for narrow heads and flanges. Single standard bolt and nut is taken out for jaw removal. Outer jaws are also reversible end for end. Four sizes for pipe and fittings from ¼ to 8 in. All are made from wrought steel with all parts interchangeable.

J H Williams & Co, 400 Vulcan St, Buffalo 7, N. Y.

STAINLESS-STEEL SHIMS P1240

Wide selection of sizes is included in dispenser-type box; ranging from paper thin 0.001 to 0.031 in. thickness. Standard size is 6x50 in.

Precision Steel Warehouse, Inc, 4409-25 W Kinzie St, Chicago 24, Ill.

ROTARY AIR MOTOR P1236

Variable-speed with simple valve control, and explosionproof safety in hazardous locations, are incorporated in this No. 8 rotary-vane air motor. Operating range is from ½ hp at 1500 rpm for the reversible type. Nonreversible models deliver up to 1 hp.

Units are adaptable for air pressures from 30 to 80 psi. Motor uses from 20 to 100 cfm, depending on speed and load. Since the unit cannot burn- when slowed or stalled, it offers new possibilities for applications requiring frequent stop-and-go operation. Bulletin AM-855 is available from manufacturer.

Gast Manufacturing Corp, Benton Harbor, Mich.

VALVE GRINDER P1214

Semiautomatic operation, high precisions, fine-finish valve grinder grinds the faces of automotive and aircraft valves with face angles of 0 through 62½ degrees, diameters of 7/16 through 3¼ in. and stem diameters up to and including ¾ in. Grinder is designed to give high-speed production results.

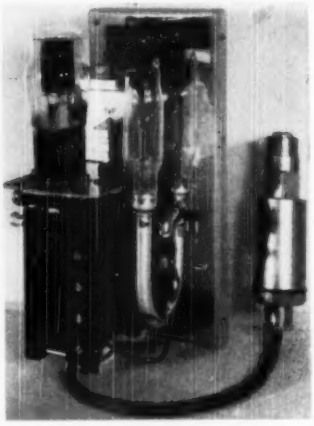
Norton Co, 1 New Bond St, Worcester 6, Mass.

SETSCREW CONNECTOR P1246

This solderless connector is available in two sizes: No. 11 and 22 to handle all common wire combinations met in branch circuit wiring. Sleeve and setscrew are brass and hence corrosionproof. No solder, tape or special tools are needed to apply the connector; the screwdriver tightens the one setscrew.

Shell can be removed at any time for inspection of splices. Entire connector can be unscrewed and reused when making circuit changes.

Ideal Industries, Inc, 1025 Park Ave, Sycamore, Ill.



ULTRASONICS TO REMOVE AND PREVENT SCALE P1231

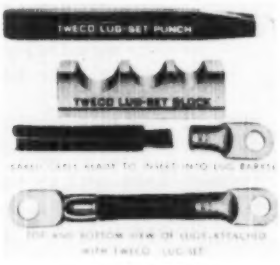
Crustex produces ultrasonic waves to remove and prevent limestone scale, $CaCO_3$, in boilers, water heaters, air-conditioning units and similar devices using water. Frequency is 27,000 cps, electrical consumption 0.02 kw. Unit can be arranged to operate on any ac voltage. Mercury thermic commutator charges and discharges a condenser. Impulses are conducted to a solenoid and cause a tube containing magnetostrictive material to produce oscillations.

Velan Engrg Co, 1 Exchange Place, Jersey City, N. J.

ACID-RESIST COATING P1247

This paint resists corrosive action of sulfuric acid in storage batteries. It is used to coat steel battery trays.

The Electric Storage Battery Co, Philadelphia 32, Pa.



LUG-SETTING TOOLS P1235

Lug-Set solderless lug and splicer set. Bronze block has three half-circle depressions to take three sizes of lugs and splicers. To use the tool set, simply strip cable end and insert in correct size lug or splicer. Next place lug in the correct depression in block.

Barrel of lug or splicer is then forced into the cable strands, using the special tool steel punch that goes with the set. The impacted copper-to-copper contact assures good conductivity and strength.

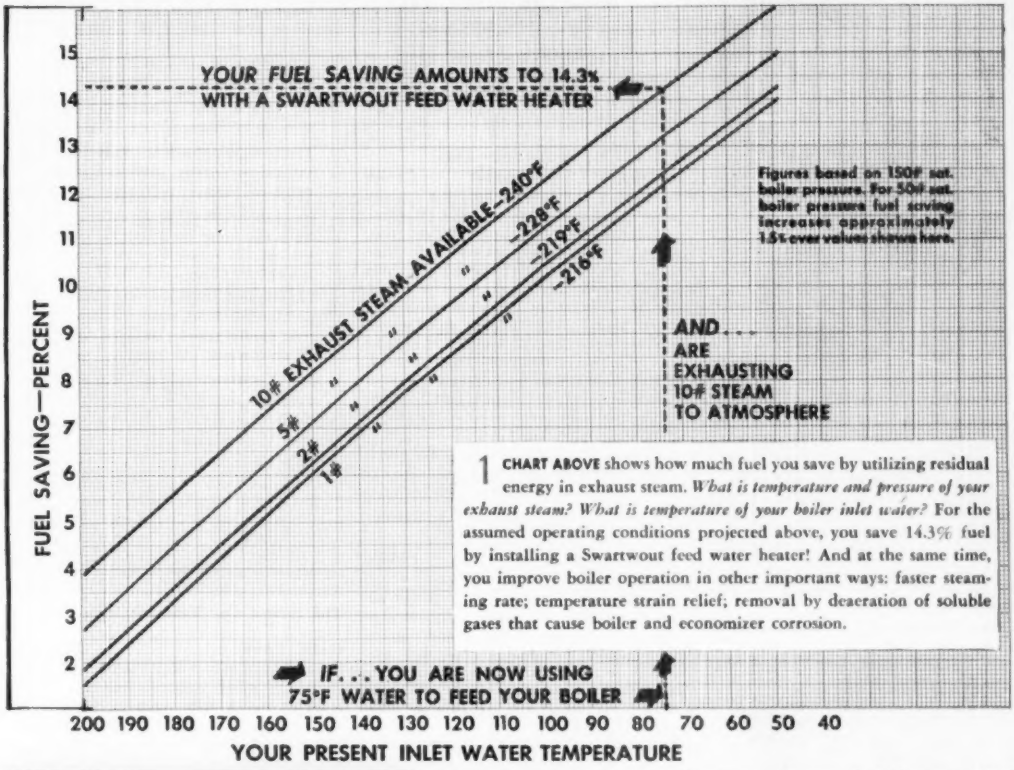
Tools are well suited for fast, efficient installation of lugs in the plant or field.

Tweco Products Co, PO Box 666, Wichita 1, Kans.

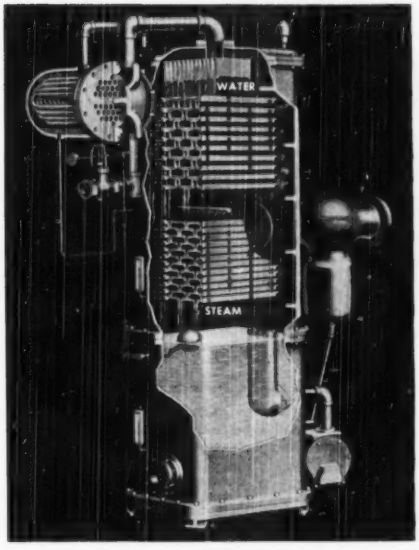
(*Continued on page 152*)

For further data on above items use reply cards on page 196a, identifying your request with letter *P* and number

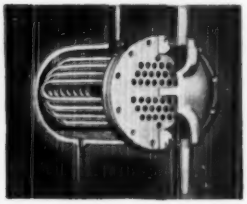
Use exhaust steam! Swartwout feed water heaters save 1% fuel for every 11° temperature rise



1 **CHART ABOVE** shows how much fuel you save by utilizing residual energy in exhaust steam. *What is temperature and pressure of your exhaust steam? What is temperature of your boiler inlet water?* For the assumed operating conditions projected above, you save 14.3% fuel by installing a Swartwout feed water heater! And at the same time, you improve boiler operation in other important ways: faster steaming rate; temperature strain relief; removal by deaeration of soluble gases that cause boiler and economizer corrosion.



2 **COUNTERFLOW** heating and deaerating, a feature of all Swartwout feed water heaters, assures efficient removal of contaminating gases! Just before dropping into storage section, feed water is in contact only with clean steam, thereby preventing reabsorption of oxygen. Through counterflow, last traces of oxygen are removed from feed water according to law of partial pressures of gases.



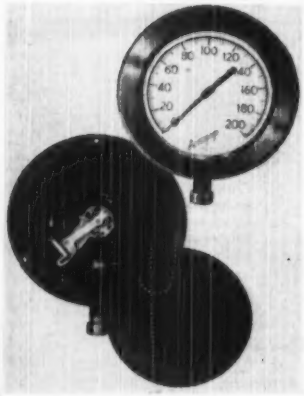
3 **VENT CONDENSER** is smaller in heaters utilizing counterflow principle. Because less steam does more work, a large condenser is totally unnecessary – important from the standpoint of maintenance economy. Swartwout makes a complete line of deaerating and open heaters —from 5,000 to 300,000 lbs. capacities.

A-2078

Swartwout

POWER PLANT EQUIPMENT

SEND FOR BULLETIN S-18-E • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

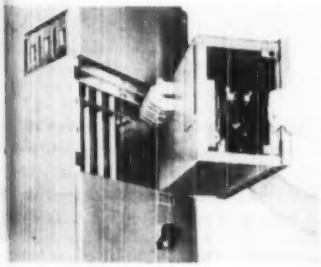


SOLID FRONT METERS P1202

A solid cast web backs up the dial of new line of solid front *Acragages*. Entire back of case has a waterproof blowout disk bonded to meter by Buna N.

For bourdon-tube rupture from any cause the blowout disk lets go and relieves the pressure (anything from ½ to 3 psi) in the case. The solid front prevents fracture of glass. Meters designed from 4½ to 10 in. diameter, for ranges from 30-in. vacuum to 80,000 psi.

Clapp Instrument Co, Webster, Mass.

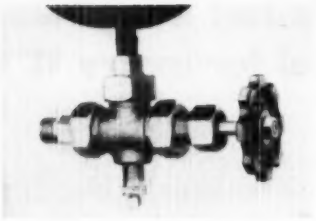


DEAD-FRONT SWITCHBOARD P1233

Custom-built *Centr-A-Power* units are designed to group power and lighting switches in one deadfront, free-standing package. Unit consists of a series of vertical rigid steel troughs into which switching devices may be inserted. All troughs are connected by continuous power bus, fed from bottom or top.

Individual switchboard units take power from silver-plated vertical bus bars to spring-loaded stabs attached to back of each unit. Standard 18-in. troughs mount circuit breakers up to 600 amp, and fusible switches up to 200 amp, 600 v, maximum.

Trumbull Electric Mfg Co, Plainville, Conn.



INSTRUMENT-PIPING AND GENERAL-USE VALVES P1226

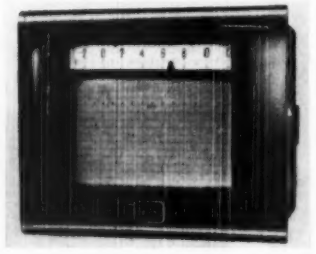
These valves reduce threaded connections from ten to three. They combine unions, nipples, reducers, elbows, tees, valve and drain valve in one unit. Nine styles include valves with or without union outlet as well as offset and jacketed valves. On all or many of the nine valves are: safety shutoff, double-seating stem for repacking under pressure, choice of regular or quick-closing stem and lever, regrindable and renewable seats, pressure-bleeder valve and test-gage connection, outside screw and yoke when desired and throttling stem when specified.

Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass.

DUCT SIZING P1210

All factors you need to consider in selecting the right duct size can be picked off with *Ductulator*, a multiple-scaled circular slide rule. Knowing air volume and velocity the engineer can find friction loss per 100 ft of duct, diameter of round duct, dimensions of rectangular duct to carry needed quantity of air. The rule has four colors on four scales.

The Trane Co, La Crosse, Wis.



STRIP-CHART INSTRUMENT P1234

High-speed, self-balancing ac bridge for measuring temperature, resistance, conductivity, strain, position, etc. In fact, any variable that can be measured in terms of impedance.

Measured variable is recorded on a chart 11¼ in. wide. Instruments are available for as many as 16 different records on same chart. All *Dynamaster* strip-chart instruments are housed in moisture-fume-dustproof case.

The Bristol Co, Waterbury 10, Conn.

GAGE CASE P1216

New square cases, with the same bolt circle and round cutout in the panel as standard round flush cases of the same dial size, can now be had for flush mounting on panels. Width of square front flange is less than diameter of the conventional round front. Available in 4½, 6 and 8½ in. dial sizes.

Helcoid Div, American Chain & Cable Co, Inc, Bridgeport 2, Conn.

REVOLVING JOINT P1215

Noncorrosive metals, plus special redesigning for special packings like Teflon, Nylon, Kel-F, feature improved self-aligning revolving joints for paper mills, textiles and other industries, using heating and cooling equipment like slashers, dry cans, rotating rolls.

All packings are stationary seals. Rotation takes place on nonporous carbon disk only. Rotation speeds go up to 1000 rpm.

Rotherm Engineering Co, Inc, 4911 W. Irving Park Rd, Chicago 41, Ill.

INSULATING RED ENAMEL P1238

This enamel dries to handle in a half hour and dries hard in eight hours. No. 32 Enamel has long shelf-life along with bonding well to insulating materials and metals. It is an excellent finish for

(*Continued on page* 168)

Thumb Back a Few Pages And Check These, Too . . .

Lube-Spray Valve allows spraying oil or grease into open gearing or sliding surfaces. Valve needs compressed air for operation ..... p 168

Flexible Coupling designed to handle parallel and angular misalignment up to 12 deg. ..... p 170

Temperature-Control Valve for heating or cooling processes using water, oil, steam or other fluid p 170

Oxygen Analyzer that's fully automatic and needs no chemicals. Operates on the magnetic susceptibility of a sample of gas ..... p 174

Gear-Speed Reducer fitted into a packaged drive for transmitting power at desired speed. Combines a helical gear, motor and coupling p 176

Fan Ventilator for installations requiring duct-exhaust ventilators operating at low noise levels p 178

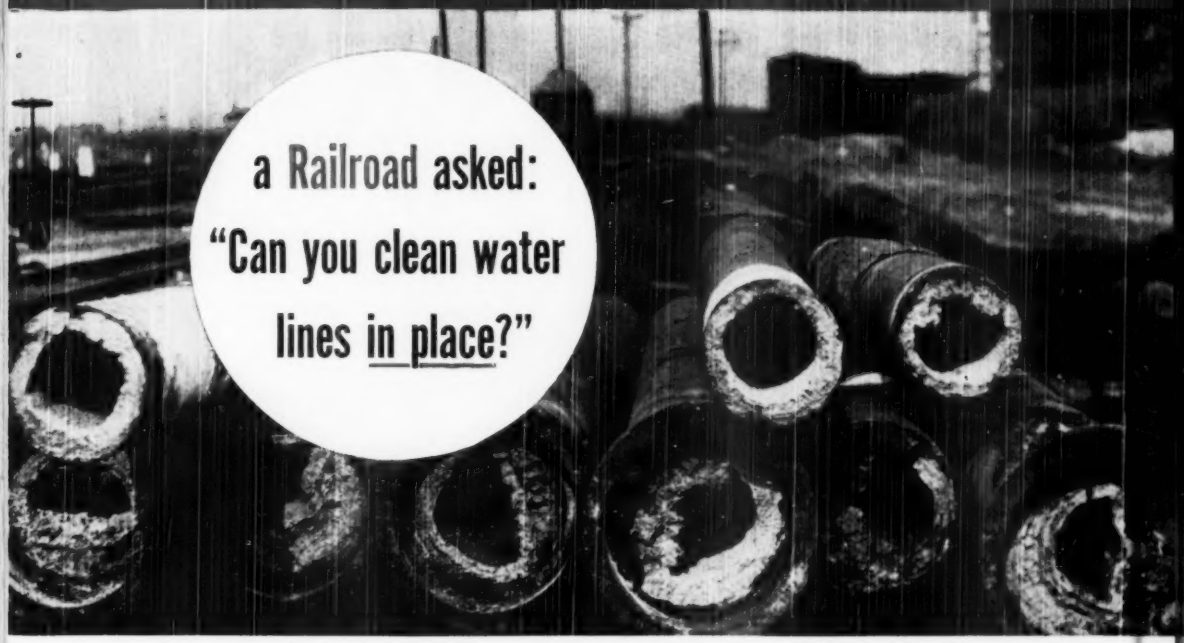
And Next Month . . .

Prelubricated Bearings, along with removable-bracket covers, spotlight this line of dc motors

For further data on above items use reply cards on page 196a, identifying your request with letter *P* and number

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



Dowell Service cleaned over 8600 feet of buried water line in six days!

You don't have to dig up water lines in order to clean them! Take the case of a major railroad that had over 8600 feet of *buried* water lines, ranging from 2 to 12 inches in diameter. The capacity of these lines had been greatly reduced by scale deposits. Dowell Service cleaned all the lines, *in place*, in only six days with a minimum interruption in service.

Dowell Service offers *fast*, effective cleaning of pipelines—underground or above, indoors or out. No digging or dismantling is necessary. Dowell liquid solvents, designed to dissolve the accumulated deposits, are introduced through regular connections. Because they are liquid, Dowell solvents reach wherever steam or water flow, cleaning places inaccessible to other methods—angles, curves, valves, complicated surfaces and hook-ups. *Experienced* Dowell engineers do the job, using Dowell-designed, truck-mounted pumps, mixers and control equipment.

Many other types of equipment can also be cleaned efficiently, economically by Dowell Service. If you have boilers, condensers, evaporators, bubble towers, water wells or other operating equipment where deposits are reducing capacity, let *Dowell Service save you time and money* in maintenance cleaning!

Other recent Dowell jobs:

Water well cleaned for large utility. Original production of 1150 gpm had dropped to 550 gpm. Dowell Service brought production back to 1100 gpm.

★

Boiler cleaned for steel company. Steam production before Dowell Service: 115,000 p.p.h.; steam production after Dowell Service: 145,000 p.p.h.

★

Air cooling system on two 22,500 K.W. generators cleaned for Midwestern Utility company in four hours. Before Dowell Service, the operating temperature of the generator was at the maximum allowable of 60° C. After service, the temperature was a normal 50° C.

CALL

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

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Long Beach, Oakland, Casper: Dowell Associate—International Cementers, Inc.

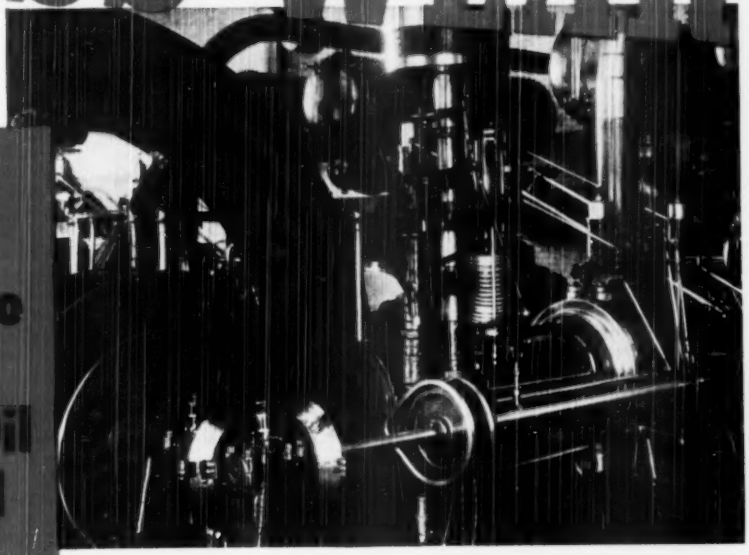
DOWELL

A SERVICE ORGANIZATION

et's not forget that the same power that lights our Christmas trees this year is once more turning out the tools of war. But only through the greater Power, whose Son we honor at this time, can we change "Peace on Earth, Good Will to Men" from simple words to simple truth. All the power we will ever control can never do it alone.

George Edwards

MORE POWER LESS WEAR



When you use the Texaco Steam Cylinder Oil designed for your operating conditions

Whatever your operating conditions, and whatever the age or size of your steam engines, there is a Texaco steam cylinder oil designed to assure you effective lubrication and lower maintenance costs.

To get best performance from your steam engines, use the oils recommended by your Texaco Lubrication Engineer. These oils will atomize completely; coat cylinder walls and pistons with a tough, adhesive lubricating film that withstands wear, wash-off, and highest temperatures. Rings stay steam-tight . . . valves function properly . . . upkeep costs come down.

If steam is used for processing, there are Texaco steam cylinder oils especially designed to separate rapidly from exhaust or condensate.

For greater all-'round steam engine performance call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

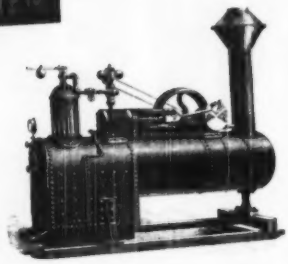
TEXACO

TEXACO Steam Cylinder Oils

FOR ALL OPERATING CONDITIONS

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

THEN



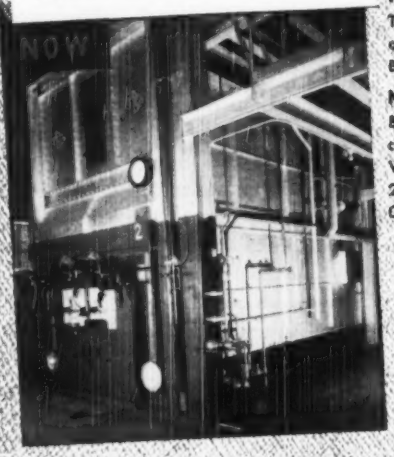
WHAT'S IN BETWEEN THESE BOILERS BY BIGELOW ?

Between the two Bigelow boilers shown stands almost a century of boiler-making experience. During those years, Bigelow's reputation has been written in steam by thousands of successful, efficient and long-lived boiler installations all over the world.

What This Means To You

When you are in the market for a new boiler, you will benefit by what has happened in the time between these two boilers. You will get the advantage of the experience and progress in design, construction and inspection embodied in Boilers By Bigelow.

Write for free catalogs on any of the units listed.



THEN

This coal-fired boiler was one of the earliest Boilers By Bigelow.

NOW

Bigelow boiler installed recently at Waterbury Hospital, Waterbury, Conn. Capacity 23,000 lbs. steam per hour. Oil-fired.

Boilers By Bigelow

Water Tube Boilers — Bent Tube Types
Horizontal Return Tubular Boilers
Scotch Type Boilers
Two-Pass Boilers
Electric Steam Generators

8J-3

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ELECTRONICS

(*Continued from page* 124)

This delays until L_2 the instant when the ac rider crosses the critical. Firing of the tube is delayed as indicated by the shaded area and it delivers less power to the load. Fig. 2*X* to 2*Z* show that by adjusting the dc bias the ac rider can be moved up or down to increase or decrease the period during which tube T_1 conducts. In this way excitation applied to the drive's magnet coil is controlled to adjust output speed.

Grid Voltage. Assume that S_2 has the polarity shown. Current then flows from—on S_2 through C, and P_1 to + on S_2 to charge C_2. A bias is applied to grid of T_1 from — on S_2 through C_2, part of P_1, R_1, grid to cathode, part of P_3, R_2 to + on S_2. Potential of this bias can be adjusted by moving arm A_1 across P_1. When arm A_1 is to full right the bias has maximum potential and when A_1 is to full left the ac bias potential is zero.

A plus dc bias is applied to the grid of T_1 from — on S_1 through coil A, part of P_2 to A_2, cathode and grid of T_1, R_1, part of P_1 and P_2, cathode and anode of T_2 to + on S_1. In parallel with P_2 and P_3 is a circuit from B through R_2, arm A_2 to B_1 and the cathode of T_2. Current flowing in this circuit causes a voltage drop from arm A_2 to B_1. This opposes the potential of the plus dc bias on the grid of T_1, so the bias equals the volts drop across P_2 from A_2 to C minus that from A_2 to B_1 and part of that across P_1. When arm A_2 is on B, plus dc bias on the grid is maximum. It will then equal volts' drop from B to C across all of P_3, minus drop from A_2 to B_1. Assume this bias lifts the ac rider, *FGHI* so it crosses the critical voltage at A, Fig. 2*Y*. Tube T_1 conducts all of wave *ABC*, and full voltage is applied to the drive's magnet coil for maximum output speed.

Moving arm A_2 to C cuts P_3 out of the grid circuit so C is connected directly to the cathode of T_2. Volts' drop across P_2 from arm A_2 to B_1 is now effective as a minus dc bias on the grid of T_1. This bias is applied from B through R_2 to A_2, R_1 the grid to cathode to C and D, and to cathode of tube T_2. If this bias drops, the ac rider to where it passes through C, Fig. 2*Y*, tube T_1 will not conduct. Then, drive-coil magnetizing current is zero as is also the output speed.

From this we see that by moving arm A_2 on P_2 from B to C, full output speed range of the drive is obtained. When A_2 is on B, maximum plus dc bias is applied to T_1 grid. Turning A_2 clockwise we reach a point where the volts' drop from B to A_2 equals that from A_2 to B_1. At that point dc bias on the grid is zero and the ac rider has the position *FGHI*, Fig. 2*X*. Further movement of

There's a Chapman Valve

for every pressure or temperature range

No matter what the power plant specification — what the pressure and temperature range — you'll find a Chapman valve to meet it. Every one is manufactured to full A. S. A. standards for port diameters and wall thicknesses — all have straight-through ports. Available in flanged, welded or pressure sealed body and bonnet connections.

At the Power Show
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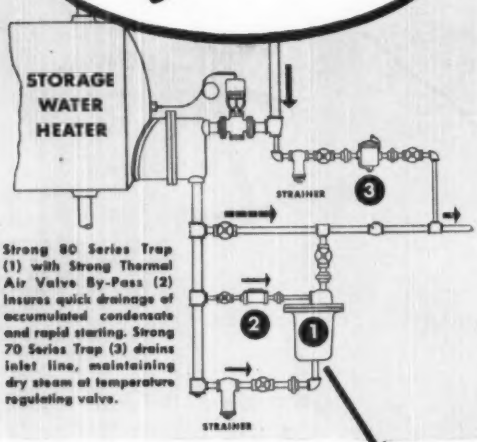
CHAPMAN DISPLAY
Booths 46 and 47

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

GET
Proper Drainage!



Strong 80 Series Trap (1) with Strong Thermal Air Valve By-Pass (2) insures quick drainage of accumulated condensate and rapid starting. Strong 70 Series Trap (3) drains inlet line, maintaining dry steam at temperature regulating valve.

PROBLEM: Condensate accumulates in coils due to lack of pressure when thermostatic regulating valve is throttling or closed. *Improper drainage and water hammer result when thermostatic valve opens.*

SOLUTION: *Drain coils fast.* Use trap with four to eight times capacity of actual steam condensate rate. For medium or high pressures, either open or inverted bucket traps are suitable. *Use open bucket traps for low pressures.*

Completeness of the Strong trap line enables our engineers to recommend exactly the type or size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc., forged, welded, cast or semi-steel construction. Bring your drainage problems to us for solution. Send for Strong Trap Catalog No. 68-P today for complete details of *all* Strong traps.

Strong 80 Series Trap for medium or high pressures.

Strong 30 Series Trap for high, medium or low pressures.

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OTHER STRONG STEAM SPECIALTIES

Reducing Valve

70 Series Trap

Strainer

STRONG

arm A_2 to the right reduces volts' drop from A_2 to C below that from A_2 to B_1 and a minus dc bias is applied to T_1 grid.

Speed Range. Position of arm A_2 on P_2 determines the range of speed adjustment that can be obtained. For example, if A_2 is on B_1 and A_3 is on C, the two arms are connected together from B_1 to C, so there is no dc bias on T_1 grid. P_2 is cut out of the grid circuit and is not effective in applying a minus dc bias. Therefore, speed adjustment is from full speed down to that obtained with an ac bias only on the grid.

If arm A_3 is on B and A_2 on C_1, we assume that volts' drop across P_3 and P_2 are equal. Then since they oppose, dc bias on the grid is again zero and output speed cannot be increased above that obtained with zero dc bias on the grid. If A_3 is moved toward C, volts' drop between A_3 and C decreases and a minus bias is applied to T_1 grid to reduce output speed. Therefore, by positioning A_2 on P_2, speed range of the drive can be fixed.

Tachometer Generator. Driven from the drive's output shaft, a tachometer or pilot governor generator serves to hold constant speed after it has been adjusted to a given value. This generator is a small ac single-phase unit with a permanent-magnet field structure. Its magnetic field is, therefore, constant to generate a voltage that varies directly as the speed. This generator connects to a transformer, whose secondary S_4 connects to tube T_2 to form a full-wave rectifier through small anodes N.

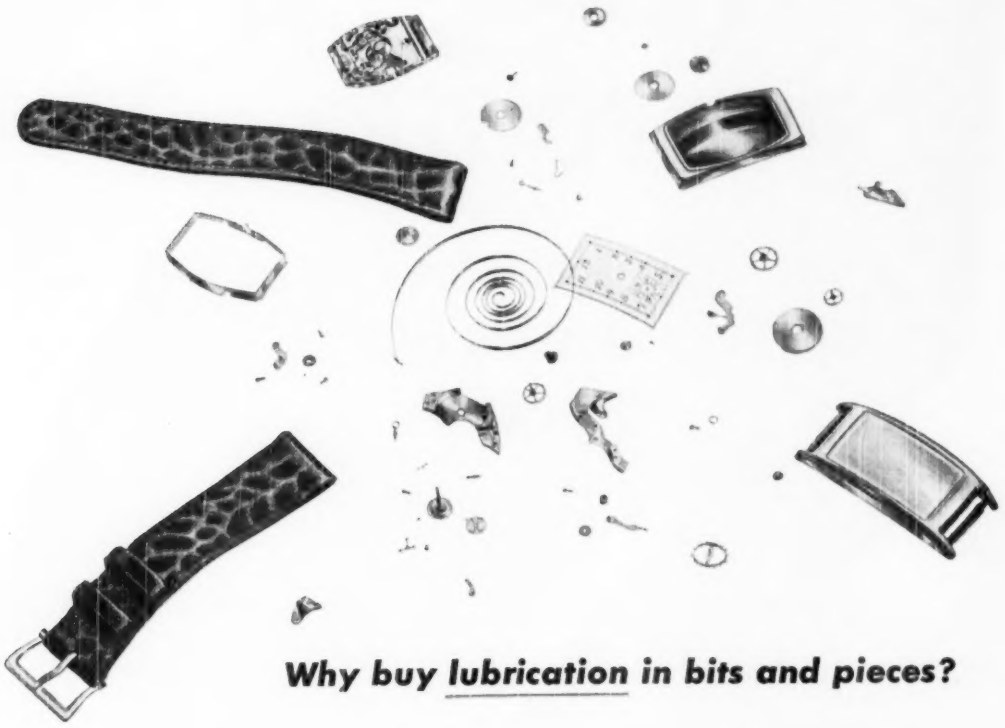
Assume S_4 has the polarity shown. Current then flows from its center tap CT through P_2 to T_2 cathode, the top small anode to + on S_4. This current causes a voltage drop across P_2 that affects dc bias on T_1 grid. Assume the control has been adjusted for a given output speed which has been obtained and that operation is stable. Also assume T_1 grid has a plus dc bias.

If the load decreases on the drive, its speed will tend to rise and increase the voltage of the tachometer generator. Current through P_2 increases as does the voltage drop across it. This increase in voltage drop opposes the plus dc bias to reduce it and in doing so reduces the drive's output speed and returns it to nearly adjusted value.

Conversely, if load increases, output speed tends to decrease and with it speed and voltage of the tachometer generator. This reduces current through P_2 and the volts' drop across it. Opposition to the dc plus bias is reduced and it increases to up the magnetizing current in the drive's coil and return output speed to the set value.

The speed-regulation action described for the tachometer generator on a dc plus bias also holds when the dc bias

YOU WOULDN'T BUY A WATCH THIS WAY...



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Correct Lubrication is a lot more than just drops of oil and dabs of grease.

It's knowledge of your machines and their exact lubrication needs. It's the *right* lubricant, applied the *right* way. It's engineering service that helps you create one unified lubrication program throughout your plant.

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has the
POWER
to make
tough tube
cleaning jobs
EASY

Power is the stuff that makes the new ROTOJET stand out from all other tube cleaners. It makes tough jobs ridiculously easy. Uses less air, too. Get a powerful, rugged ROTOJET, and no other cleaner will ever satisfy you. Air or water-driven models for practically any size straight or curved tubes.

ROTOJET Air-driven Motor Model 525 with swing-frame head and universal joint for 2¾" to 3" I.D. curved tubes.

ELLIOTT COMPANY-ROTO DIVISION
153 Sussex Avenue Newark 1, N. J.

is minus. As a result speed is held practically constant at a given setting, regardless of reasonable changes in load or line voltage.

Filters Smooth Ripples. Capacitors C_6, C_7 and C_{10} act as filters to smooth out the ripples in the voltage and help to maintain it constant. For example, when the voltage of S_3 is increasing, C_6 is charged to the polarity shown at maximum voltage. When S_3 voltage decreases, C_6 discharges through P_3 and tube T_3 to help maintain voltage constant across them. Capacitors C_7 and C_{10} perform the same functions on potentiometer P_2. Capacitors are effective in both the P_2 and tachometer-generator circuits.

Where accurate output speed control is not required this controller can be had without the tachometer generator. Without this generator to govern the speed the unit is known as a clutch motor. Output speed of such a unit varies wtih the load when excitation is held constant in the magnet coil. For example, with 30% excitation and 90% rated load, output speed will be about 40%. If the load drops to 60%, output speed rises to about 85% of input value. To hold constant output speed, excitation would have to be reduced to about 15%, which would be done by a tachometer generator when one is used.

The next article will discuss electronic exciters for dc motors and generators.

TECHNICAL BRIEFS

(*Continued from page* 138)

Instruments, Controls

TRENDS IN MODERN BOILER CONTROL, *by J F Luhrs, Bailey Meter Co.* Four trends have appeared in modern boiler and power-plant design, which present interesting and sometimes complex control problems for solution. These trends are multiple fuel burning, higher pressures and temperatures, control of boiler-water level by varying pump speed in plants of unit design, centralized control rooms.

Fundamental control problem in burning multiple fuels, either singly or in combination, is the same as when burning a single fuel. In other words, provide (1) energy input to furnace sufficient to maintain steam pressure at desired value (2) fuel-air ratio which wil lgive optimum combustion efficiency.

The first is not a serious control problem. Fig. 4 (p 138) is a setup that fires gas when and as available, and simultaneously varies rate of fuel oil so rate of heat input to furnace is not greatly affected. The numbers in the drawing are the air-loading pressure ranges of the various control devices in psi.

As far as the second requirement,

Ladish Elbows

...A Complete Size Range Another Reason to Specify *Controlled Quality*

SEAMLESS WELDING FITTINGS

From the small fitting that weighs several ounces to the half-ton giant . . . whatever your fittings requirement, the Ladish line provides you with an unrestricted choice of sizes in a complete range of types, weights and materials. In addition, every fitting offers the added dependability assured by the high manufacturing and metallurgical standards of Ladish Controlled Quality.

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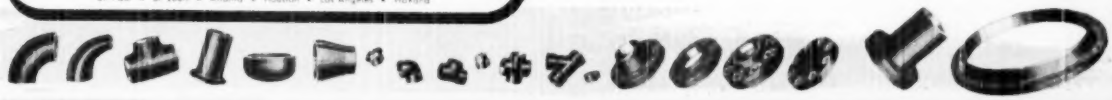


Cast iron
Plain case
Plain ring

Cast iron or cast brass
Plain case
Screwed ring

Cast iron
Flanged cast
Plain ring

Cast iron or cast brass
Flanged case
Screwed ring

Cast iron or cast brass
Flanged case
Flared ring

Cast iron or cast brass
Flush mounted

Phenol
Flanged case
Screwed ring

Drawn steel
Plain case
Plain ring

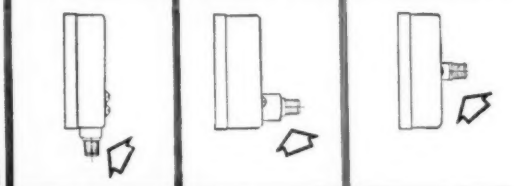
Drawn Steel
Square case
Plain ring

Drawn brass
Plain case
Screwed ring

Drawn steel
Flanged case
Plain ring

Drawn steel
Flush mounted

Available with bottom, lower back, and center back connections



Getting down to cases...

. . . here are some of the many available in Marsh Gauges

Not content with merely making the finest of pressure gauges, we make them in the widest range of types, pressure ranges, dial sizes, case patterns and case finishes.

As an example of how far we have gone in making gauges ideally suited to every need we show here just a part of the many case patterns available in Marsh instruments. Every type of case, every kind of mounting, every form of connection is represented here . . . and they are available in just about every material and finish.

Because the Marsh line offers highest quality instruments in every conceivable form, they have been accorded top preference by the most exacting users of pressure gauges. Why accept less than the instruments which have become "The Standard of Accuracy?"

Ask for catalog. It covers the scope of Marsh gauges in pressure vacuum, compound, altitude, hydraulic, sprinkler, ammonia, retard, test and diaphragm types. Marsh products also include dial thermometers, heating and refrigeration specialties, and the Electrimatic line of refrigeration regulators and solenoid valves.

MARSH INSTRUMENT COMPANY
Sales affiliate of James P. Marsh Corporation
Dept. F Skokie, Ill.
Export office 155 E. 44th St. New York, N.Y.

MARSH GAUGES

THE STANDARD OF ACCURACY

JUST SAY

OIC

FOR

For any valving requirement, you can specify OIC Valves and be sure of efficient, precise control. That's because OIC Valves are:

PRECISION ENGINEERED—positive closure . . . minimum friction . . . designed for smooth, free flow of air, gases and liquids.

PRECISION BUILT—every essential part accurately finished for a precise fit, on the most modern production equipment.

PRECISION APPLIED—OIC engineers always available to help you select valves best suited to each job, at lowest cost.

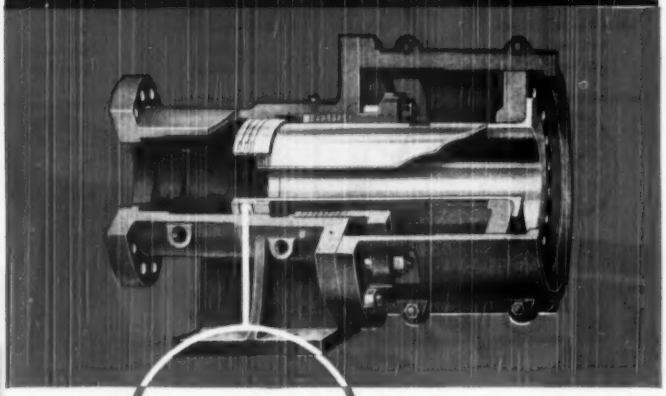
Here's a three-way combination that provides "*precision valve*" *equipment* in your plant. First costs and upkeep costs are lower. See your local OIC distributor, or write us direct. Ask for a free copy of the 1950 OIC Valve Cross-Reference Chart. The Ohio Injector Company, Wadsworth, Ohio.

OIC
FOUNDED 1883

VALVES

FORGED AND CAST STEEL · IRON · BRONZE

Keep pressure IN THE LINES and OFF MAINTENANCE MEN!



ADSCO *Piston-Ring* EXPANSION JOINTS can be packed under full line pressure!

An ADSCO Piston-Ring Expansion Joint pays for itself many times over by eliminating the costly service interruptions and operational losses which naturally result from packing ordinary joints. Your maintenance men can completely repack this joint without shutting off pressure in the lines.

ADSCO's exclusive piston-ring feature—with combined internal guides—holds the line pressure even when the packing is completely removed. Venting the relief chamber exhausts any accumulated steam that may have passed the rings and, with no pressure against the stuffing box, all packing may be withdrawn.

ADSCO'S EXTRA FEATURES include...

NO SCORING OF SLIP because it is in contact only with the packing. The piston rings ride the machined bore of the body.

COMPLETE GUIDING both internally and externally. The external guide is split to facilitate packing and to permit installation in smaller spaces.

LIMIT STOPS prevent over-travel. The slip cannot be pulled from the body while in operation.

PACKING LUBRICATION is provided to prolong packing life and ensure smooth performance of the slip.

NON-FREEZING GLAND STUDS AND BOLTS are of non-corrosive metal and always accessible through special openings in the external guide.

ADSCO Piston-Ring Expansion Joints are available in a full range of sizes, in both single and double units, with 4", 8" or 12" traverse per slip, for pressures to 400 psi and greater, and for temperatures to 750F. and higher. For additional information, see your nearest ADSCO representative or *write for Bulletin No. Z-35-15F.*

Expansion Joints
Steam Traps • Meters
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Since 1877

Heat Exchangers
Strainers • Separators
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fuel-air ratio, goes it is easier to understand how the problem is handled if it is restated—that is, to maintain Btu input in the form of fuel in that ratio to air input for optimum combustion efficiency. Fig. 3 shows relationship between theoretical pounds of air per pound of fuel for various commercial coals and the pounds of air required per 10,000 Btu liberated from the same coals. Former ratio varies from 7.2 to 10.8 while latter remains substantially constant. These same curves could be drawn for all available fuels and would show pounds of air required from natural gas to anthracite coal per Btu released constant within 5%.

So the problem of automatically proportioning fuel and air becomes one of measuring Btu input and then supplying air for that input regardless of whether one or more fuels are burned singly or simultaneously. *ASME paper No. 50-F-17.*

ULTRASONIC METHOD FOR MEASURING WATER FLOW, *by W B Hess and S K Waldorf, Safe Harbor Water and Power Corp, and R C Swengel, consultant.* The authors say their experiments toward determining water velocity by ultrasonics, originally devised by Swengel, appear applicable to large bodies of water. Further, these experiments may lead to applying the method to large-scale measurements in the discharge of hydroelectric-plant turbines. Ultrasonic method appears to have distinct advantages over existing methods of measuring discharge of turbines in large hydroelectric stations. In carrying the method to the present development state a great many difficulties have been overcome. It now appears that diligent effort can overcome the remaining obstacles in applying the method to large-scale measurements. *AIEE paper No. 50-214.*

HIGH-SPEED SUPERVISION OF PROCESS VARIABLES, *by W E Belche, Jr, Minneapolis Honeywell Regulator Co.* Various field surveys into industrial needs for instrumentation have brought to light a number of specific applications for supervisory control. The predominant one is the need for continual checking of bearing temperatures on rotating machinery. This machinery runs the gamut from aviation gas turbines through marine installations to central stations. Speed of scanning in these cases runs from one point every two seconds to ten points per second.

Tube and boiler temperatures in central stations are also of prime importance. Speeds required run from two to ten seconds per point and the type system required may be total or selective logging, or both.

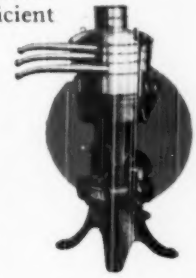
This supervisory or monitoring control is not completely new. It has its

WHIRLING MILESTONES

De Laval today offers a centrifuge for every purification need in the power field. Back of every recommendation stands nearly three-quarters of a century of being ***first*** in major centrifugal developments.

1878 Carl Gustav De Laval invented the first continuous Cream Separator. He tried tubular bowl design.

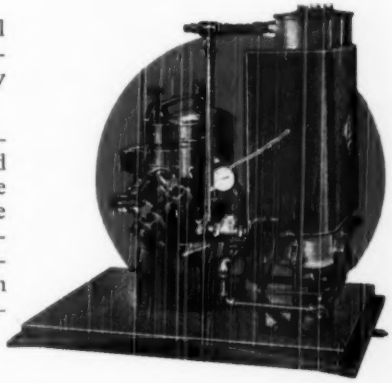
1890 Dr. De Laval abandoned tubular bowl, invented slower-speed disc bowl to stratify liquid for more efficient purification.



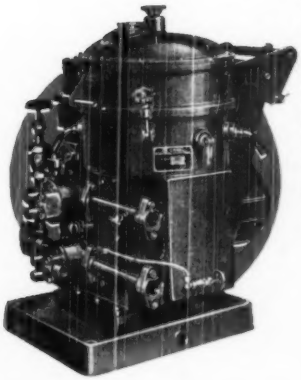
1918 First centrifugal Oil Purifier introduced by De Laval. This continuous Oil Purifier was driven by a small steam turbine.

1922 First De Laval centrifugal Insulating Oil Purifier installed. In 1950, the centrifuge is still the safest way to maintain insulating oil because water, once discharged, cannot recontaminate the dry oil.

1950 Full range of "Uni-Matic" Oil Purifiers now available, including No. 67 with a capacity of approximately 450 gph.



De Laval "Puri-Filter," combining centrifugal force and filtration, makes possible the removal of fly ash or moisture haze as well as more dangerous impurities. The "Puri-Filter" is the ultimate in turbine or engine oil lubrication purification.



THE DE LAVAL SEPARATOR COMPANY
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IN POWER PLANTS,
the right answer to every temperature and pressure Fittings Problem is W-S Screw End and Socket Weld Forged Steel Fittings.

Basic materials are selected from a wide choice of chrome-moly, carbon and alloy steels. Designs are carefully engineered. Fittings are drop forged for strength . . . precision machined for accuracy of finish, and instrument inspected for perfection of threads, sockets, angles and concentricity. Investigate them today.

Write for Bulletin A3-50. For information on Stainless and Alloy Steel Fittings, ask for Bulletin S-1.

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FORGED STEEL FITTINGS

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WATSON-STILLMAN Established 1848
Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

beginnings rather far back in industrial technology, but it does represent a new frame of reference for the instrument manufacturer. Its presence is the result of an inevitable evolution.

The author describes various monitoring systems and illustrates the instrumentation of some. A typical graphical panel as applied to a catalytic cracking unit comes up for discussion. Such a panel is illustrated. *AIEE paper No. 50-218.*

INSTRUMENTS FOR DETECTION OF TOXIC AND EXPLOSIVE GASES, *by N W Hartz, Mine Safety Appliances Co.* When combustible fuels reach a generating station they bring with them numerous applications for instruments designed to detect toxic and flammable gases. The plant that burns gas as a fuel must recognize the possibilities for leakage through valves, regulators, tees and other pipe fittings. Since natural gas is essentially odorless, colorless, tasteless some automatic means should be provided to warn of its presence in significant concentrations of combustibles (about 5% in air is enough to produce an explosive mixture). *AIEE paper No. 50-221.*

A DIRECT-RECORDING TECHNIQUE FOR PRESSURE CYCLES IN HIGH-PRESSURE RECIPROCATING EQUIPMENT, *by R A Strub, E I du Pont de Nemours & Co, Inc.* Need for obtaining information concerning performance of high-pressure piston compressors or pumps by a simple method led to this study of a direct-recording technique making use of the strain in the plunger rod. The axial strain is easily recorded by strain gages connected through an amplifier to a pen recorder or oscilloscope. Main advantage of this method is that it avoids modification of the machine, and strain gage can be left permanently attached for frequent or constant survey even when processing a corrosive fluid.

This strain-gage method has been used to record pressures in the cylinder of a compressor as low as 200 psia and is sufficiently sensitive to give accurate information about valve operation (opening, closing, leaking, etc), packing friction, gas compressibility, output efficiency, indicated power, vibrations caused by valve instability, plunger bending, misalignment, cylinder cracks, etc.

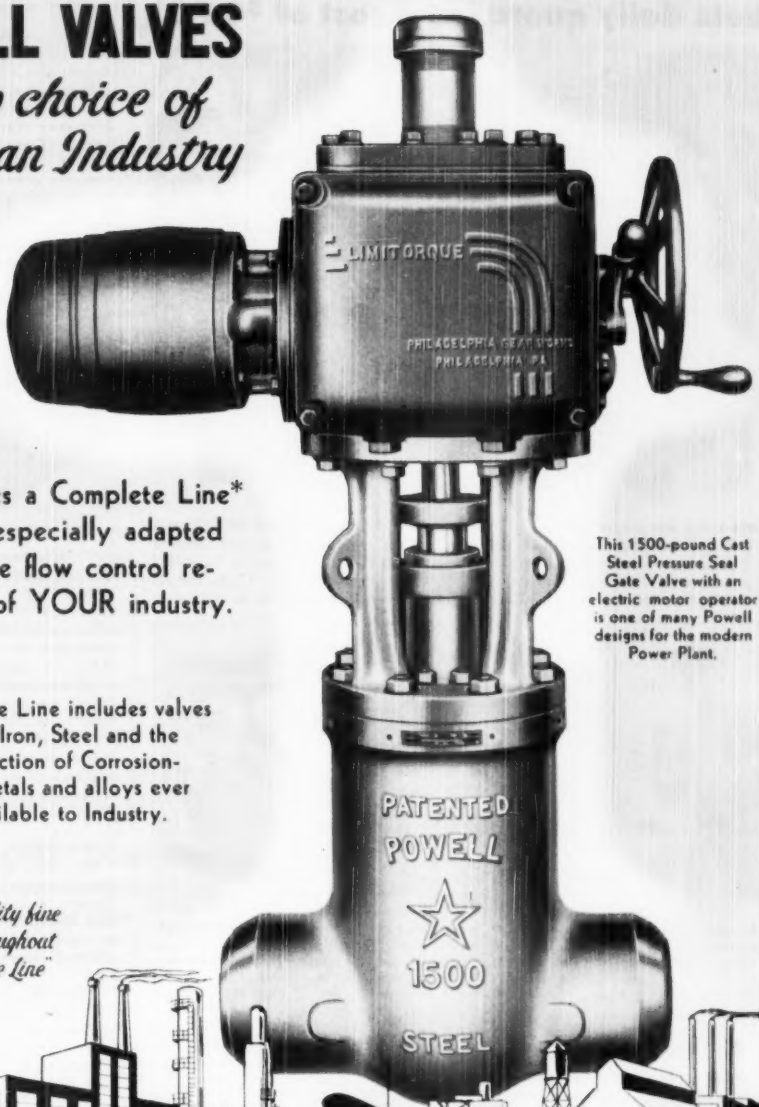
Paper illustrates method of attaching and wiring strain gage and contains charts of tests run on 120-rpm high-pressure gas compressor by both strain-gage and direct-recording methods, together with a mathematical discussion of the theory of strain measurements. *ASME paper No. 50-HRD-2.*

THE CONTROL VALVE IN OPERATION, *by G A Philbrick, G A Philbrick Re-*

(Continued on page 204)

POWELL VALVES

the top choice of American Industry



Powell Makes a Complete Line* of Valves especially adapted to meet the flow control requirements of YOUR industry.

This 1500-pound Cast Steel Pressure Seal Gate Valve with an electric motor operator is one of many Powell designs for the modern Power Plant.

*The Complete Line includes valves in Bronze, Iron, Steel and the widest selection of Corrosion-Resisting metals and alloys ever made available to Industry.

Quality fine throughout "The Line"

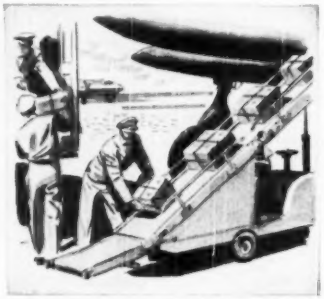
POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

Completes 300 TV sets— meets daily quota (at a cost of $4.70)

Delicate coils were needed by Midwest manufacturer to complete 300 TV sets . . . and Massachusetts supplier was 920 miles distant! Air Express assured delivery by 8 o'clock next morning, so manufacturer ordered 500 men to report for work. Shipment arrived 7:20 A.M.—production rolled! Shipping cost for 17-lb. carton only $4.70! Manufacturer uses Air Express regularly to keep business in high gear.

$4.70—and special pick-up and delivery included! Low Air Express rates cover door-to-door service. More convenient—easy to use. Just phone for pick-up! (Many low commodity rates in effect. Investigate.)



Air Express goes on all flights of Scheduled Airlines. Shipments keep moving around the clock—speeds up to 5 miles a minute. *Experienced* handling. Phone Air Express Division, Railway Express Agency, for *fast action*.

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World's fastest transportation method.
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1150 cities served direct by air; air-rail to 22,000 off-airline points.
Experienced Air Express has handled over 25 million shipments.

Rates include pick-up and delivery door to door in all principal towns and cities

A service of
Railway Express Agency and the
SCHEDULED AIRLINES of the U.S.

EQUIPMENT NEWS

(Continued from page 152)

bus-bars, commutator connections, stator ends, field coils, etc. When dry it has a dielectric strength of 800 v per mil. Coating offers good resistance to oils, moisture, chemicals, etc.
Irvington Varnish & Insulator Co, 6 Argyle Terrace, Irvington 11, N. J.

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

RECORDING OSCILLOGRAPH **P1237**

Device is designed for permanent recordings of electrical wave patterns necessary in either the study of transient conditions or straight analysis of wave shape. A quick-change, 10-speed transmission is available as an optional feature to use the wide range of record speeds from ¼ to 100 in. per sec. Power source is a governor-controlled motor directly geared to the recorded roll in the magazine.
Consolidated Engineering Corp, Pasadena, Calif.

LUBE-SPRAY VALVE **P1242**

With this device, either grease or oil can be sprayed onto open gearing, slide surfaces, or any other area where a measured amount of lubricant is to be applied at regular intervals. Spray valve can be operated wherever compressed air is available.

Valve may be used as an addition to the regular *Farval* lube system on a complete system of spray valves served by either manual or automatic pumping unit.
Farval Corp, 3251 E 80th St, Cleveland 4, Ohio

DIESEL ENGINES **P1227**

Intended primarily for stationary service, such as generator drive, pumping on oil or gas pipelines, municipal water

SEATLESS MEANS ECONOMY

IN BOILER BLOW-DOWN SERVICE

Because they eliminate the commonest source of trouble and expense in ordinary blow-off valve service, Yarway *Seatless* Blow-Off Valves mean real economy to boiler plant operators. *Yarways have no seat to score, wear, clog and leak.* Lubrication is usually the only maintenance they require.

Yarway introduced the seatless principle with the balanced sliding plunger many years ago . . . has constantly improved and adapted it to meet modern service requirements. Mechanical and metallurgical research in Yarway's own Steam Laboratory anticipates changing conditions . . . keeps Yarway valve design ahead.

There is a Yarway Seatless Blow-Off Valve for every pressure. Iron body for 50 to 200 lbs., steel body for higher pressures.

SEND FOR FREE BLOW-OFF VALVE BOOKLET. PLEASE INDICATE THE PRESSURE OF YOUR BOILERS.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
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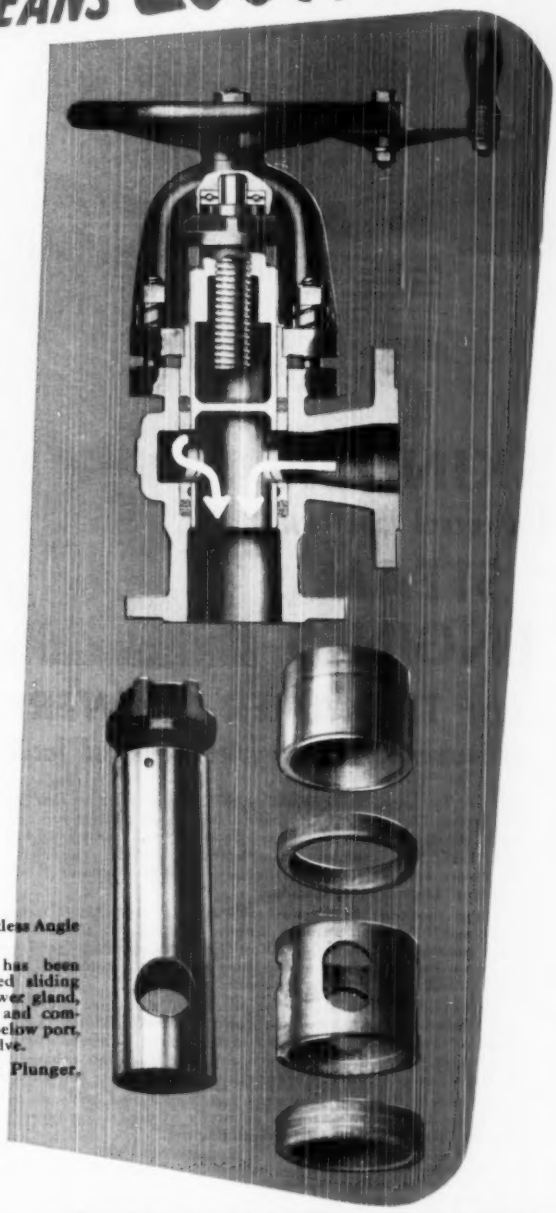
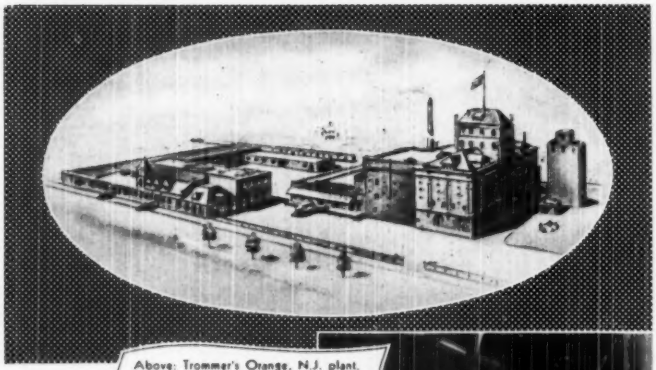


(*Above*)—Cross section of Seatless Angle Valve, flanged.

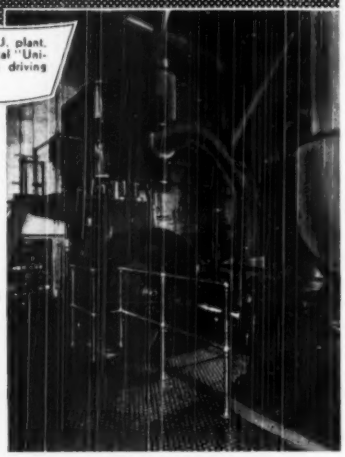
OPERATION: After valve has been closed, shoulder on balanced sliding plunger contacts upper follower gland, forcing it down into body and compressing packing above and below port, making an absolutely tight valve.

(*Below*)—Balanced Sliding Plunger, Packing Rings and Glands.

YARWAY BLOW-OFF VALVES



Above: Trommer's Orange, N.J. plant. Right: Skinner 2-cylinder Vertical "Universal Unaflow" Steam Engine driving ammonia compressor.



7 SKINNER "Universal Unaflow" STEAM ENGINES for TROMMER BREWERIES as increasing sales require expanded facilities

John F. Trommer, Inc., Brooklyn, N. Y., purchased its first Skinner "Universal Unaflow" Steam Engine, driving an electric generator, in 1928. As the result, in 1933 when Trommer acquired an old brewery in Orange, New Jersey, and completely remodeled it, the selection of the power source was a natural conclusion—two Skinner "Universal Unaflow" Engines being installed.

Since that time, as increased sales required expanded facilities, one additional "Universal Unaflow" Engine was installed in the Brooklyn plant and three "Universal Unaflow" Engines in the Orange plant. Of the seven engines now installed, three are directly connected to compressors and four to electric generators.

Breweries, dairies, and other processing industries have found a double economy in producing their own power with Skinner "Universal Unaflow" Steam Engines, because in addition to a dependable source of low-cost power they have been able to employ the exhaust steam for hot water generation, pasteurization, space heating and other uses.

In widely diversified industrial and institutional fields, more than 2,000 installations attest to the economy of generating power with Skinner "Universal Unaflow" Steam Engines.

Our engineers are prepared to make accurate estimates, which may prove you can produce dependable power in your plant at a fraction of the cost of purchased power. Write for detailed information about the advantages of Skinner "Universal Unaflow" Engines in your field.

For Over 80 Years, Doing One Thing Well—Building Steam Engines

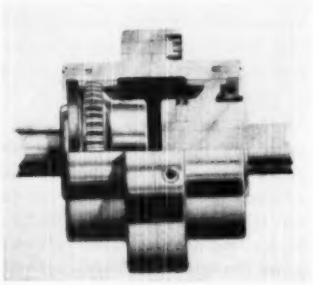
SKINNER ENGINE COMPANY, ERIE, PA.

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

pumping, etc, these engines are 4-cycle 17x20-in. units with speeds of 257 to 375 rpm. Available with 6 and 8 cyl, normally aspirated or supercharged, capacities range from 700 to 2080 bhp.

Bedplate, frame and cylinder housing are welded construction. Double-wall cylinder liners with individual water jackets, individually cast cylinder heads, welded exhaust and intake headers and hydraulic relay-type governor are other features of the engines.

Baldwin Locomotive Works, Philadelphia 42, Pa.



FLEXIBLE COUPLING P1245

Dihedral coupling is designed to handle angular and offset misalignment up to 7 deg; special models can handle up to 12 deg. Misalignment capacity is based on tooth shape. Coupling eliminates most alignment problems caused by normal bearing wear, and setting foundations. Bulletin 50 gives further details.

Ajax Flexible Coupling Co, Inc, Westfield, N. J.

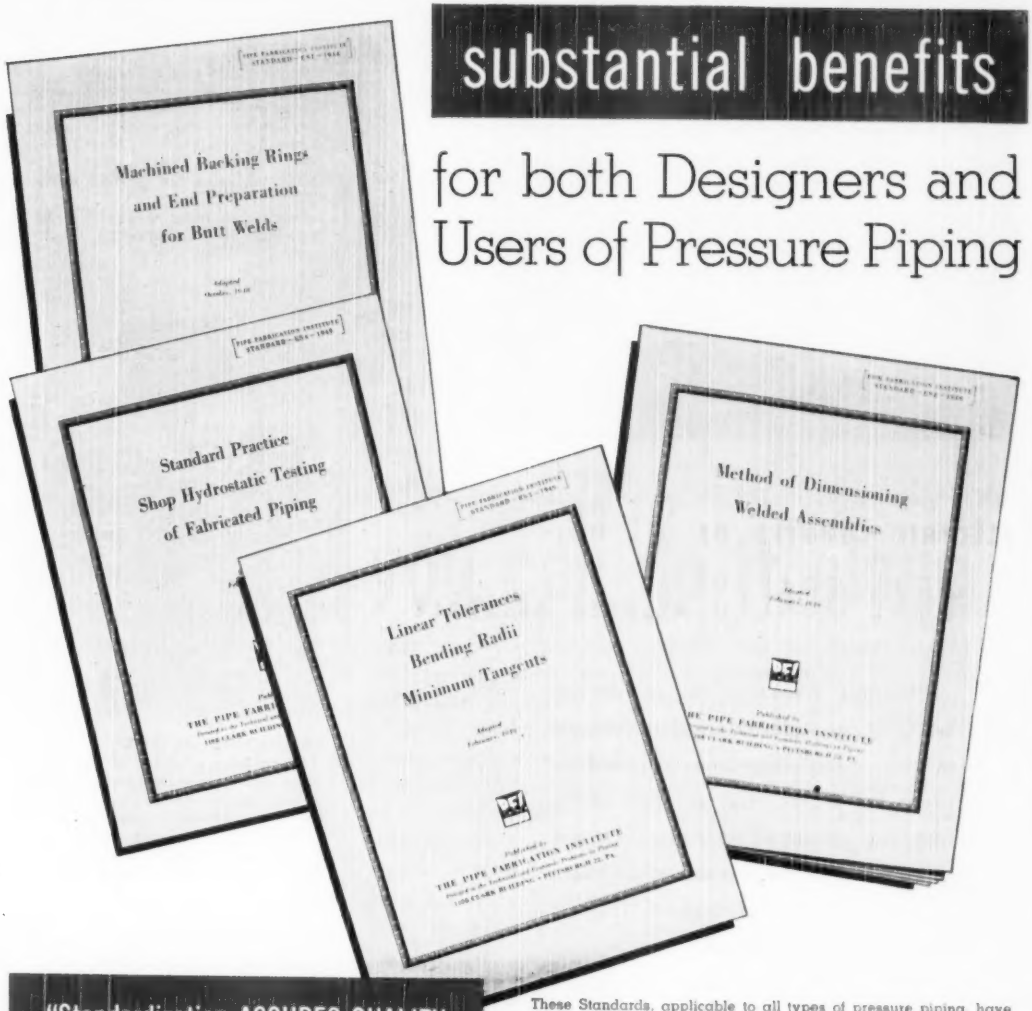
TEMPERATURE-CONTROL VALVE P1223

Suitable for heating or cooling processes using water, oil, steam or other fluids, *Sterlco Series 150E* is self-contained unit. Consisting of bellows-packed valve with stainless-steel trim and monel bellows, a capillary tube and a thermostat bulb, flow through valve is automatically modulated

These PFI STANDARDS have

substantial benefits

for both Designers and Users of Pressure Piping


Machined Backing Rings and End Preparation for Butt Welds
Standard Practice Shop Hydrostatic Testing of Fabricated Piping
Linear Tolerances Bending Radii Minimum Tangents
Method of Dimensioning Welded Assemblies
THE PIPE FABRICATION INSTITUTE

"Standardization ASSURES QUALITY and PROMOTES ECONOMY"

These Standards, applicable to all types of pressure piping, have been compiled by the PFI. Their purpose is to suggest standardized design features and procedures for designers, fabricators, contractors and users of pressure piping.

Designing engineers have found these Standards helpful in getting better piping and maximum value per dollar of cost. Also, they save time on the drawing board, in procurement of materials and during erection of the job.

The four Standards illustrated here have been issued so far, and more will be forthcoming. If you are concerned with pressure piping, you will find it to your advantage to have copies of these Standards. Simply fill in and mail the coupon.

The Pipe Fabrication Institute,
1108 Clark Bldg., Pittsburgh 22, Pa.

Please send me without cost the PFI Standards now available, also place my name on your mailing list to receive additional Standards as they are adopted.

Name _____

Title _____

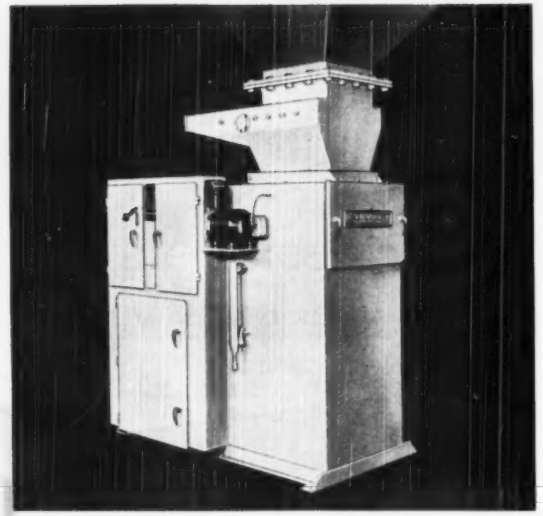
Company _____

Address _____

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH 22, PA.



ELECTRIC COUNTER OF S-E-CO.

COAL SCALES ASSURES ACCURACY

Electrical operation of counters on S-E-Co. Coal Scales means that there are no mechanical connections required between the counter and any part of the weighing system. Therefore, there can be no errors in weights due to improper adjustment of a mechanical linkage. Counter may be located on scale or where desired.

Why not use S-E-Co. Coal Scales in your plant and obtain accurate coal weights with the electric counters.

Write for bulletin.

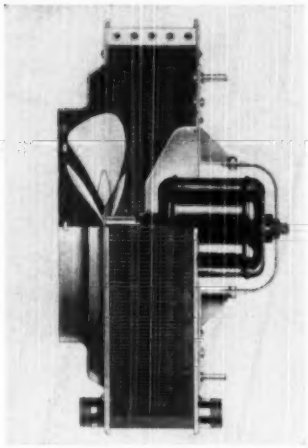
STOCK EQUIPMENT COMPANY

715P Hanna Building · Cleveland 15, Ohio

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

in accordance with temperature at bulb. Constant temperature, adjustable over wide range, can be maintained. Built in two styles: direct-acting for heating (valve closes as bulb temperature rises) and reverse-acting for cooling (valve opens as bulb temperature rises). Sizes: ½, ¾ and 1 in.; maximum pressure rating is 125 psi.

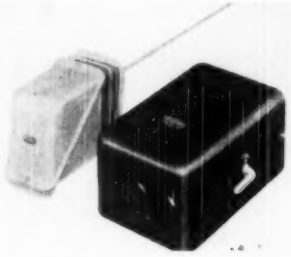
Sterling, Inc, Indus Control Div, 3738 N Holton St, Milwaukee 12, Wis.



PROJECTION HEATER P1211

An attractive offset roll at bottom gives added rigidity and improved appearance to new line of projection unit heaters. Only the motor and housing brackets protrude beyond top of unit. Motor can be removed either through the top or through the discharge orifices on larger models. A new model, 275-P, has 35-in. fan and 451,000-Btu capacity. Other models range from 55,300 Btu for No. 100 P to 550,000 for 300 P.

Trane Co, La Crosse, Wis.



FLAME FAILURE P1217

Complete flame-failure protection and programming for industrial and commercial automatic gas burners can be had with a Fireye system consisting of (1) a 24 PJ8 programming control and (2) a 45 JQ1

SURE you can do it alone

After you've bagged your deer, the first few hundred yards back to camp seem easy. Then you begin to wish you'd left the kill lie and that you'd gone back for help. The last stage of the journey you'd rather forget . . . makes you wish you'd never even seen a deer.

It's the same thing when you get tangled up in the details of a pipe installation . . . Seems easy at first, but you soon wonder who got you into the mess. The thing to do, of course, is to turn such matters over to the experts. We've been installing high-temperature, high-pressure piping for more than half a century, and have pioneered in methods for handling stainless steel, so you don't need to hunt for a firm with the skill and experience. Repeat orders from some of the country's largest utilities and processing plants prove our competence. Let us bid on your next contract.

WESTPORT, CONN.
W. H. MITCHELL & CO., INC.
29 E. ELLSWORTH STREET
PHILADELPHIA 44, PA.

REPRESENTATIVES IN BOSTON, NEW YORK, CLEVELAND, MOBILE AND HAVANA

MITCHELL

Btu's are "Shop-Lifters" if given half a chance. When they wander from the straight and narrow, they **push** operating costs sky-high, drive efficiency and employee morale way down . . . and **walk** off with much of your profit.

Keep Btu's in line by protecting your equipment with CAREY Industrial Insulation. When you do, Btu's will work like beavers —you'll save fuel, increase efficiency, too!

And to keep Btu's on the job at high temperatures—here's a new, improved insulation

Carey Tempchek

a specialized material with a temperature range up to 1500° F., low K-factor, rugged strength, excellent Handleability—

It's a combination of outstanding qualities

Ask about it!

CAREY Makes The Complete Line

85% Magnesia—Industrial Rock Wool Asbestos—Pipe Coverings—Sheets—Blocks—Batts—Papers—Air-Cell

Write for your free copy of "Heat Insulation For Industry." Address your request to Dept. **PO-12.** The Philip Carey Manufacturing Company, Cincinnati 15, Ohio. In Canada: The Philip Carey Company, Ltd., 1557 MacKay Street, Montreal 25, P.Q.

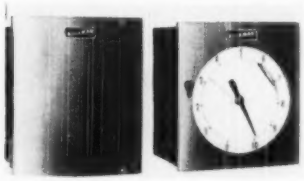
Call your Carey representative today. He's a trained expert who is eager to serve you.

Carey

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

electronic flame rod. Programming control automatically starts up and programs the burner in operation. Flame rod will not allow the main gas valve to open until the pilot flame is established and detected.

Combustion Control Corp, 77 Broadway, Cambridge 42, Mass.



OXYGEN ANALYZER **P1207**

Completely automatic, requiring no chemicals, new oxygen analyzer operates on basis that oxygen is unique among gases in that it is paramagnetic (attracted into a magnetic field, rather than slightly diamagnetic). This magnetic property is such that oxygen concentrations can be determined down to a few parts per million by measuring magnetic susceptibility of sample gas.

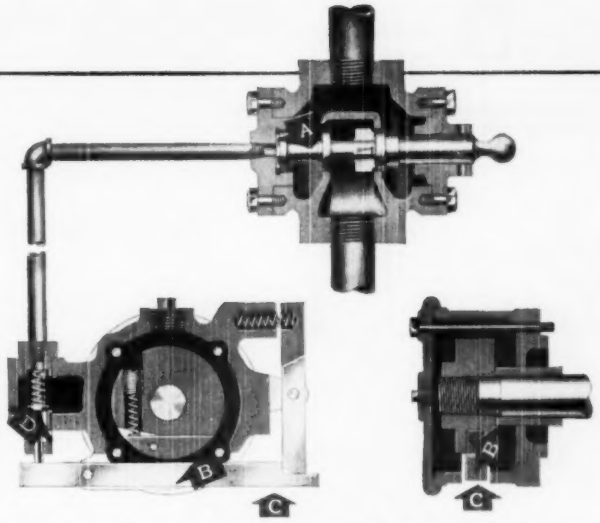
By using simple electrical circuits easy standardization, multiranges, high sensitivity, accuracy and control can be had. Analyzer covers the entire range of oxygen concentration from a few parts per million to 100%.

A O Beckman, Inc, 11 W. State St, Pasadena 2, Calif.

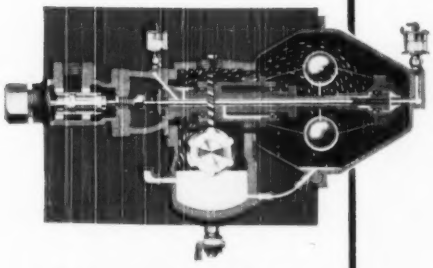
TUBE EXPANSION **P1212**

Compact, mobile unit, consisting of a welded-steel frame truck, with control systems, extra motors, expanders, mandrels, cables and accessory tools carried on

Only Coppus Turbines offer you *a pilot operated* excess speed safety trip



The constant speed governor on Coppus Turbines, plus this Excess Speed Safety Trip, gives you extra protection for your turbine investments. Here's how it works. When steam is turned on, pressure opens valve A fully. When excess speed is reached, centrifugal force throws weight B against lever C lifting pilot valve D. This releases pressure in back of valve A, closing this valve instantaneously, to shut off the steam. Safety trip can be tested easily while turbine is running by manually tripping and resetting lever C.



Sectional view showing lubricating system of fully enclosed Coppus Constant Speed Governor. Governor head acts directly on stem of steam admission valve. No external levers required. Ball bearing construction eliminates end play and gives frictionless operation.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

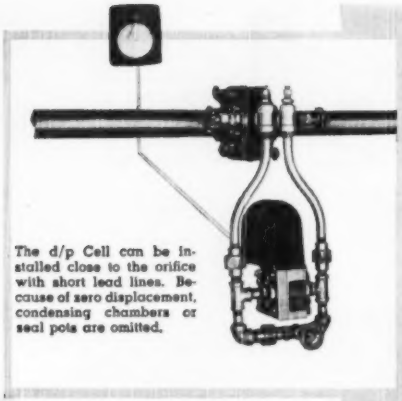
CUT YOUR COSTS PER HORSEPOWER

When you choose from the Coppus Steam Turbine line, you get the right size for your requirements . . . and make substantial savings on *any* size from the 150 hp turbine down to the smallest. Low in first cost, Coppus Turbines save you more money in the long run. Operating and maintenance costs are kept low by such other features as: large number of steam nozzles, controlled individually by manually operated valves; hard chromium plating on shaft at the stuffing box; replaceable cartridge type bearing housings; optional carbon ring packing assembly for back pressures up to 75 pounds.

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORPORATION, 172 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES



The d/p Cell can be installed close to the orifice with short lead lines. Because of zero displacement, condensing chambers or seal pots are omitted.

Simpler Flow Measurement

in the palm of your hand

NEW • REVOLUTIONARY • MERCURY-LESS

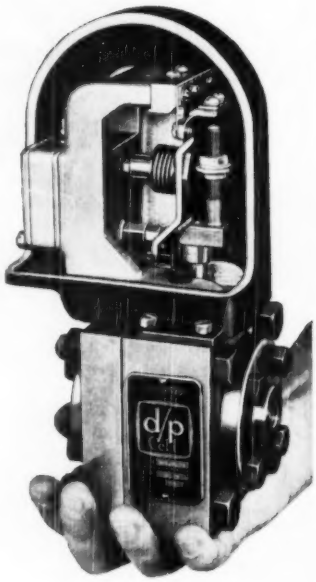
FOXBORO

DIFFERENTIAL PRESSURE CELL

How you can simplify many troublesome flow problems . . . especially those where corrosion is a factor or the use of mercury is objectionable. This unique flow measuring device is accurate, easily calibrated, and widely applicable, and it weighs only 20 lbs.

The Foxboro d/p Cell operates on the highly-accurate force-balance principle, transmitting flow measurement to remote, conveniently-located pneumatic receiving instruments (indicating, recording, controlling). Range: 80 in. to 800 in. H_2O. Working pressures: 750 psi and 1500 psi.

Get all the facts about this revolutionary new device for the measurement of liquid, steam, gas or air flow. Write for Bulletin 420. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U.S.A.**



UNIQUE ADVANTAGES

1. *Type 316 Stainless Steel Construction.*
2. *Uses no mercury.*
3. *Essentially zero displacement — no need for condensing chambers on steam measurement or seal pots on liquid measurement.*
4. *Immediate, unfailing response to differential pressure changes.*
5. *Positive overrange protection.*
6. *Easy zero and range adjustment.*

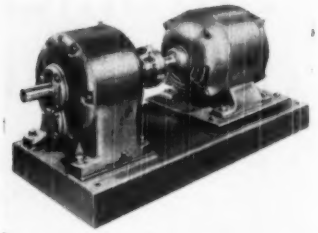
FOXBORO
REG. U.S. PAT. OFF.

RECORDING • CONTROLLING
INDICATING
INSTRUMENTS

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

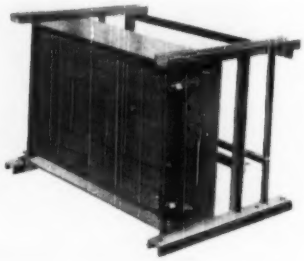
shelves, brings all elements for tube rolling into one convenient storage place.

The control itself gives uniform results with either condenser or boiler tubes as the job at hand. The control automatically stops expansion when the tube is rolled.
Airetool Mfg Co, 342 S. Center St, Springfield, Ohio



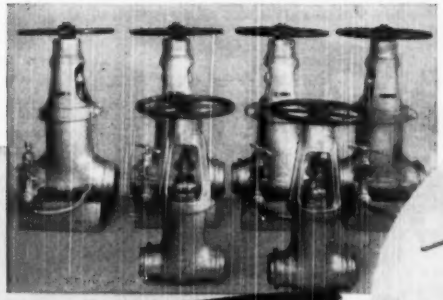
GEAR-SPEED REDUCER P1249

Package drive for transmitting power at desired speed, which is other than that of the motor. Combines a helical-gear drive, a motor and a coupling assembled on a standard baseplate. Baseplate design permits easy cleaning and is built to withstand overhung loads without deflecting. Realignment can be handled by adjusting movable plate under the motor. *Motogears* are built in a variety of sizes in double or triple reductions with a wide range of ratios and horsepowers. Input and output shafts are concentrically in line. Periodic inspection and maintenance of proper oil level are all that is necessary. **Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.**

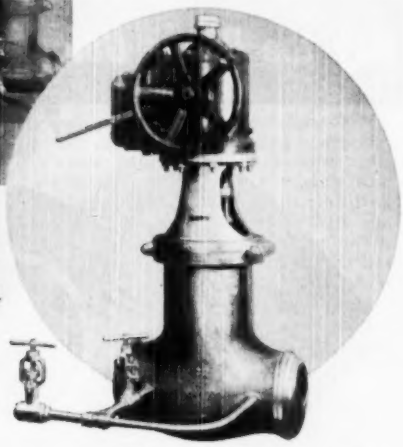


REFRIGERATION CONDENSERS P1229

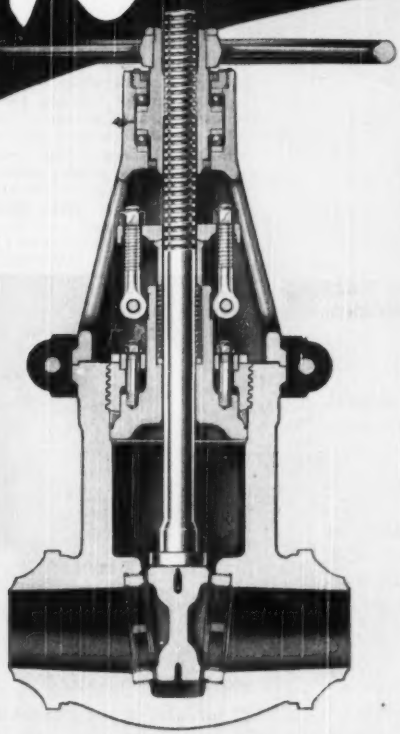
Combined air- and water-cooled refrigeration condensers are designed to save water. When air temperature is less than about 85 F in Freon systems water is not used. Rise in air temperature above about 85 F causes head pressure to increase and open a valve in water line. Cooling water then flows through inner tubes, condensing refrigerant. Water tubes are cleanable. Capacities of condensers range from 1/3 to 5 hp; units are avail-



INSTALLED in South Carolina Power Company's Plant Hagood, No. 2 Unit, at Charleston, S. C.



R·P&C



Pressure Seal Bonnet

THESE CAST STEEL gate, globe and angle valves, for use especially in high pressure, high temperature steam service, are being used increasingly for less difficult services. They offer these advantages:

1. Elimination of bonnet flanges, bolts and gaskets.
2. Tightness unaffected by temperature changes.
3. No need to restress bolting to maintain tight joint.
4. Disassembly and reassembly greatly simplified, should inspection be required.
5. Greatly reduced weight without loss of strength. Less space required. Erection simplified.
6. Insulation is facilitated and neater appearance is given to installation.

FOR COMPLETE INFORMATION, get in touch with our District Office nearest you.

ACCO

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

TRADE MARK

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

READING-PRATT & CADY VALVES

Buy the Bonus Union DART

This True Ball Joint Makes the Difference

BONUS NO. 1

Because of the precision-machined, true ball joint, a Dart can be made leakproof without excessive wrenching. Installation is fast — no need to jam a Dart to get a tight joint.

BONUS NO. 2

A Dart stays tight — bronze-to-bronze seats give longer wear — have higher resistance to pitting and corrosion. And body and nut of high test, air-refined, malleable iron are practically indestructible — shrug off wrench abuse and punishment in use.

BONUS NO. 3

Because they never require jamming, the seats in a Dart union retain their true bearing surface — stay unmarred. Thus you can reinstall a Dart again and again — yet be sure of a tight joint.

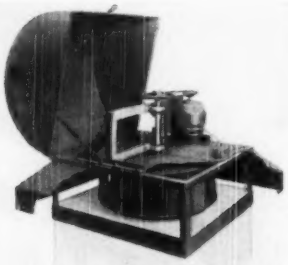
For dividends in longer service, faster installation, always specify Darts.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART UNIONS

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

able for mounting near compressor or in remote places.
Heat-X-Changer Co, Inc, 250 E. 43rd St, New York 17, N. Y.



FAN VENTILATOR **P1230**

For installations requiring powered duct exhaust ventilators operating at low noise levels, *Airlift* has a centrifugal fan with backwardly curved blades. It is mounted in a weatherproof chamber. Fan bottom is streamlined. Welded-steel framework provides support for unit, which fits over curb built to extend duct rising from building roof. The 14 sizes provide nearly 50 capacity variations.
The Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio

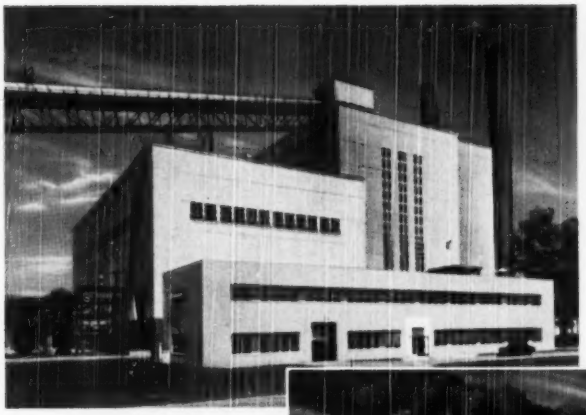
TRAPS FOR HIGH PRESSURE **P1225**

Small forged-steel traps, for high-pressure, superheated steam service, are suitable for pressures up to 500 psi with 800-F total temperature. Traps have ½- or ¾-in. pipe connections. Head and body are forged steel; internal parts are stainless steel with *Anderloy* valve and seat. Traps have a recessed gasket.

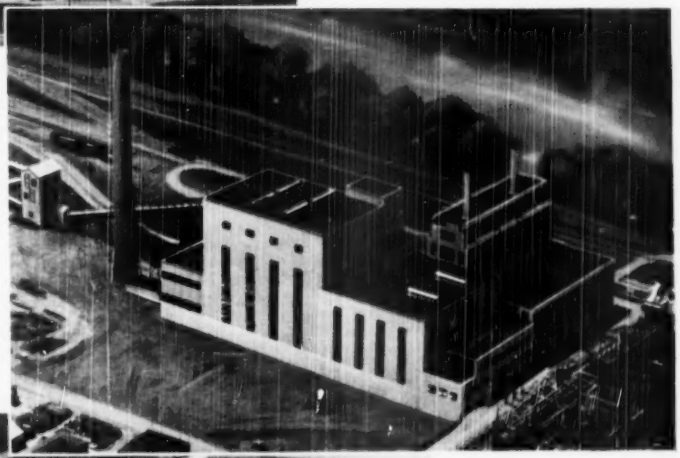
Two types are: No. 340, installed

(*Continued on page 182*)

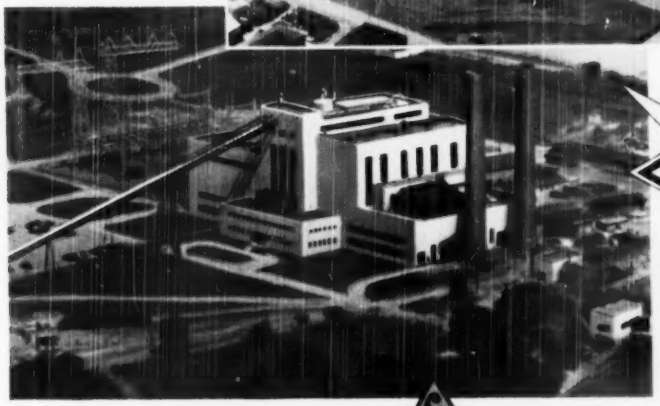
WITH THE NEED CAME THE POWER



Virginia Electric and Power Company instituted an expansion program in 1944 to more than double their electric generating capacity. These new power stations and extensions, three of which are illustrated here, are outstanding examples of efficient design for consistently reliable year-in, year-out, high-capacity performance. Facilities for this program, completed and in process of completion, will produce a total of approximately one-half million kilowatts. Design and construction are by Stone & Webster Engineering Corporation.



1. *Chesterfield Power Station, first with an installed rated capacity of 50,000 kw, has been extended with an additional installed rated capacity of 60,000 kw.*
2. *Recently completed Bremo Power Station extension, 60,000 kw rated capacity.*
3. *Possum Point Power Station where an extension of 60,000 kw rated capacity is under construction.*



VEPCo

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

ASHCROFT DURAGAUGE

"Progressive Research has meant continuous leadership for over 100 Years"

A few Ashcroft "firsts" that have anticipated the needs of industry:

1921—Ashcroft introduces the micrometer adjustable pointer.

1924—The rotary movement is announced by Ashcroft.

1929—The phenol condensate plastic case is an Ashcroft "first" this year.

1932—Bourdon Tubes of stainless steels are announced by Ashcroft research engineers.

1936—Stainless steel movements, for greater service life, join the long list of Ashcroft Gauge features.

1939—"K" Monel Bourdon Tubes, for services that would corrode stainless steel, introduced by Ashcroft.

1939—Laminated phenol dials make this year a big one in Ashcroft development.

1947—Ashcroft research engineers announce the new, revolutionary Nylon Movement*.

*Pat. applied for.

1850—A century of service to American Industry—1950

MAXWELL MANNING M&M & MOORE INC TRADE MARK

ASHCROFT *Gauges*

A Product of

MANNING, MAXWELL & MOORE, INC.

STRATFORD, CONNECTICUT

1850 ASHCROFT U.S.A.

*COLOR

For maximum production . . . top efficiency . . . lowest operating cost, give your machines the finest in lubricants—give them Tycol oils and greases.

Tycol lubricants are made to meet every lubrication need of industry—from roll neck greases for steel mills to spindle oils for textile plants.

Each Tycol lubricant is subjected to rigid tests during manufacture. This control assures the required lubrication characteristics—*COLOR, penetration, viscosity, to name a few—for maximum performance of that particular product. At every step from selection of crudes to blending of the finished product, Tycol lubricants provide maximum lubricating efficiency which means greater economy, longer life for every type of equipment.

Tide Water Associated will be glad to assist you in selecting the Tycol lubricant best suited to your specific need. Call or write your nearest office for further details.

TYCOL

INDUSTRIAL LUBRICANTS

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TIDE WATER ASSOCIATED OIL COMPANY

17 BATTERY PLACE - NEW YORK 4, N. Y.

*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA" This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

KENNEDY
Underwriters' Approved
VALVES

When you need a Valve that's always on duty . . . always ready

Whenever life and property are at stake, the complete reliability and dependability that are built into every KENNEDY Valve are plus safety features. The valves listed below are approved by Underwriter Laboratories and Associated Factory Mutual Fire Insurance Companies.

IRON BODY DOUBLE-DISC GATE VALVES

Fig. No.	Type	Sizes	Working Pressures
67	O.S.&Y. Screwed	2½" to 12"	Cold Water, non-shock, 175 lbs.
68	O.S.&Y. Flanged	2½" to 14"	2½" to 12"—Cold Water, non-shock, 175 lbs.; 14"—150 lbs.
681	O.S.&Y. Bell Ends	4" and 6" to 14"	Same as Fig. 68
701	Indicator Post Gate Valve—Flanged	4" to 14"	4" to 12"—Cold Water, non-shock, 175 lbs.; 14"—150 lbs.
702	Indicator Post Gate Valve—Screwed	4" to 12"	Cold Water, non-shock, 175 lbs.
70	Indicator Post Gate Valve—Bell Ends	4" to 14"	Same as Fig. 701

BRONZE VALVES

66	O.S.&Y. Wedge Disc Gate Valve	¾" to 2"	Cold Water, 175 lbs.
38	Hose Gate Valve no cap and chain	2½"	Cold Water, 175 lbs.
39	Hose Gate Valve with cap and chain	2½"	Cold Water, 175 lbs.
93	Angle Hose Valve	2½"	Cold Water, 175 lbs.
935	Angle Hose Valve	2½"	Cold Water, 300 lbs.

IRON BODY CHECK VALVES

125	Screwed Check Valve	4" to 6"	Cold Water, non-shock, 175 lbs.
126	Flanged Check Valve	4" to 12"	Same as Fig. 125
127A	Bell-end Check Valve	4" and 6" to 12"	Same as Fig. 125

INDICATOR POSTS

KENNEDY Indicator Posts provide a safe and easy means of operating valves installed underground or behind walls. Completely enclosed, operation is unaffected by rain, snow, or frost. Highly visible aluminum on black indicator, adjustable to valves of different sizes, protected by extra-thick moist-free glass. For wall or ground mounting.

Write for full particulars *Buy from Your Local Distributor*

THE KENNEDY VALVE MFG. CO.
1060 EAST WATER ST.
ELMIRA, NEW YORK
VALVES • PIPE FITTINGS • FIRE HYDRANTS

OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES

EQUIPMENT NEWS

(Continued from page 178)

For further data on items below, use reply cards on page v96a, identifying your request with letter P and number.

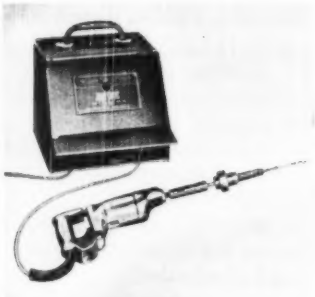
straight-in-line or as an elbow eliminating nipples and fittings; No. 60, with bottom inlet and top outlet for vertical installation. Both types have guided bucket for positive valve closing.

V D Anderson Co, 1934 W. 96th St, Cleveland 2, Ohio

GAS TORCH **P1209**

Functional design and aluminum construction feature new gasoline torches. Tanks are stronger, flared in shape, with weight to balance at any fuel level. An exclusive lock ring in the needle valve makes it impossible for valve to screw out or be forced out by pressure so no flare back of flame can take place.

Otto Bernz Co, Rochester, N. Y.



TUBE EXPANDER **P1204**

Simplified tube rolling control, *the John Crane*, is electrically operated with shockproof mountings in a rugged aluminum cabinet. Dial settings on panel are calibrated over a range of sizes and gages in both ferrous and nonferrous tubing. Expanding gun plugs into the control unit. Slight pressure on gun handle engages the con-

Hall Laboratories is set up to do all manner of things, but with just one objective—to aid industrial plants in the solution of every problem relating to the procurement, treatment, use and disposal of *water*.

The bulletins listed on this page are designed to help you determine the nature of your water problems, show you what you can do about them, and explain how Hall Laboratories can contribute toward their solution.

We will be glad to send you any or all of these bulletins. Just check the ones you want, and mail coupon to Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

☐ 1. Water Problems Neither Begin Nor End at the Boiler
Reprints of a series of advertisements tracing the course of water through an industrial plant and showing the problems which may arise at each stage

☐ 2. Your Most Important Raw Material
Showing the importance of water in modern industry and explaining the functions of Hall Laboratories

☐ 3. Let's Consider Your *Whole* Water Problem
Discuss the inter-relation of industrial water problems, from procurement to re-use or disposal, with specific case histories from several plants.

☐ 4. One-Minute Water Hardness Tests
Procedures and reagents for the new Schwarzenbach tests as adapted for field use by Hall Laboratories. Total Hardness, Calcium and Magnesium

☐ 5. Conductometric Determination of Solids
Use of Conductivity Meters for determining solids in boiler water or steam

Calgon®, sodium phosphate glass, developed by Hall Laboratories, is a powerful and versatile tool in solving many water problems. The following pamphlets describing important applications of Calgon are also available.

☐ 6. Calgon Restores Capacity of Wells—
Describing a new, effective and safe method of well cleaning which, in a number of cases, has made additional well fields unnecessary

☐ 7. Calgon Controls Corrosion—
Threshold Treatment of water supply systems and other industrial applications

☐ 8. Calgon Stabilizes Dissolved Iron and Manganese—
Prevention of "Red Water" and "Black Water"

☐ 9. Calgon Prevents Lime Scale—
With special reference to scale problems in industrial plants

HALL *plant-wide* WATER SERVICE

BOILER WATER CONDITIONING

PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER

HALL LABORATORIES, INC.
Hagan Building
Pittsburgh 30, Pa.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐

Name .....

Position .....

Company .....

Number & Street .....

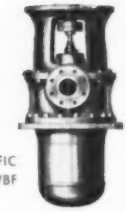
City ..... Postal Zone ..... State .....

P-12

Pacific
BOILER FEED PUMPS

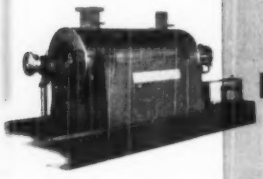
Now being built for

UTILITIES
INDUSTRIAL
POWER PLANTS
MARINE SERVICE

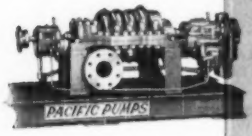


PACIFIC TYPE WBF

PACIFIC TYPE ABF



PACIFIC TYPE IBF



PACIFIC TYPE JBF

TYPE	QUANTITY	Pounds Per Hour	Degrees Temp.	Pounds Pressure
WBF	11 Pumps	47,700	259F	710
ABF	3 Pumps	230,080	281F	1110
	3 Pumps	358,120	220F	1300
	4 Pumps	350,000	300	1000
IBF	3 Pumps	425,000	310F	1825
	3 Pumps	495,000	306F	1610
	2 Pumps	450,000	310	1600
	6 Pumps	405,000	305	1750
	3 Pumps	450,000	310	1825
JBF	2 Pumps	163,600	260F	490
	1 Pump	117,500	250F	775
	3 Pumps	300,000	240	1000

PACIFIC
Precision Built
PUMPS

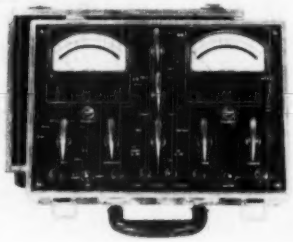
Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg.,
122 E. 42nd St., New York
Offices in All Principal Cities

BF-7R

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

trol in the circuit. This control cuts off the motor as soon as the tube is rolled to the right degree.
Crane Packing Co, Dept 2-22, 1800 Cuyler Ave, Chicago 13, Ill.



CORROSION METER **P1218**

Small, compact, 13-lb model B-3 multi-combination meter permits measurements of electrolysis, corrosion and cathodic-protection for testing or investigations. Circuit-selector switch connects the two high-sensitivity dc instruments into a variety of measuring circuits for potential, current, resistance, soil resistivity. These circuits include a low resistance 1000-ohm-per-volt voltmeter with 10 ranges from 2 mv to 100 v; a high resistance 62,500 ohm per volt voltmeter with 6 ranges from 0.1 to 20 v; a potentiometer-voltmeter with 6 ranges from 2 mv to 3 v.
M C Miller, 1142 Emerson Ave, West Englewood, N. J.

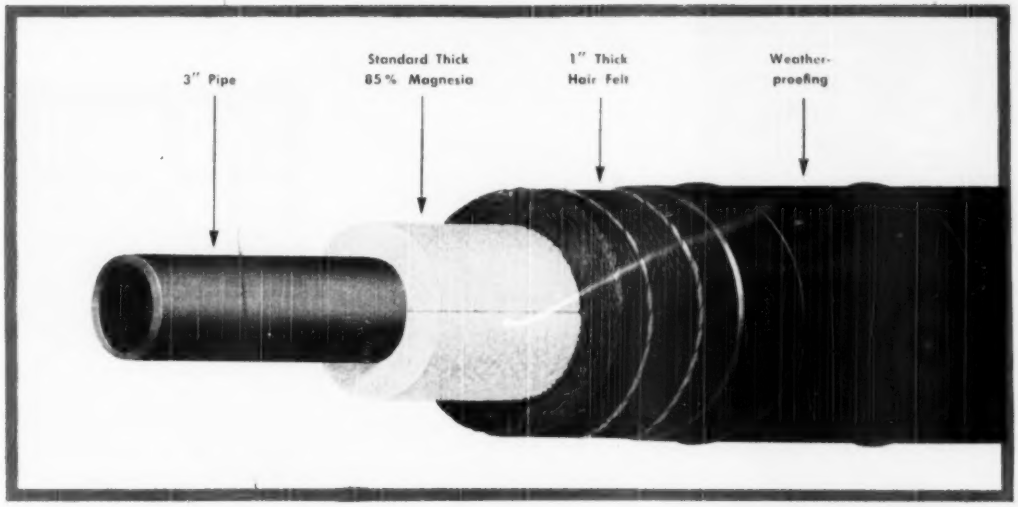
GAS-LINE TESTER **P1251**

Compact, lightweight, 1½-lb gas line tester gives a sensitive and accurate way of checking for leaks by testing in ounces rather than pounds pressure. A small aspirator develops the pressure within the line.
Marbro Mfg Co, Dept KK, 1620 Lee Rd, Cleveland 18, Ohio.

SPEED REDUCERS **P1252**

Built on the heliocentric principle these units are suitable for any straight-line installation where input speed does not exceed 1800 rpm.
Universal Gear Corp, 19th & Martindale, Indianapolis, Ind.

(Continued on page 186)



WE HAVE BEEN ASKED:

"How should I insulate an outdoor steam line that later will be enclosed in a building?"

"I have to install and operate a 3" line carrying 100 lbs. of steam that must go into service before a building is put up around it," writes an engineer from the Northern Central States. "This line will operate outdoors all winter when temperatures here often are well below zero for long periods of time. We expect to enclose this line in a building later, but that won't be until next summer or early in the fall. What's the best insulation specification for this job?"

For this application, we would recommend Standard Thick 85% Magnesia with pasted canvas jacket, wrapped with a 1" thick layer of hair felt to prevent a big drop in steam pressure during the cold winter weather. The insulation should then be weather proofed with roofing paper wired securely in place.

Next summer or fall, when the building is complete, the roofing paper and hair felt can be removed, as the Standard Thick 85% Magnesia will do an adequate job indoors. If a little care is taken, the hair felt and paper can easily be salvaged for some other job in the plant.

Regular bands can be applied over the canvas jacket, or a sewed canvas finish can be put on the line after the hair felt is removed.

Of course, insulation problems like this don't come up every day. But when they do, you can count on the engineers representing Armstrong's contracting organization to supply a practical answer. It will pay you to call in one of these men the next time you are considering buying heat insulation. Let his advice help make your job a better one. Ask him, too, about the quality insulating materials and expert application service that Armstrong offers.

SEND US YOUR QUESTIONS: If you have any questions on the use or application of either high- or low-temperature insulation, please do not hesitate to write to us. We'll do our best to give you a prompt and practical answer. Just address a letter or post card to Armstrong Cork Company, 7012 Maple Avenue, Lancaster, Penna.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 200°F. BELOW ZERO TO 2300°F.

BELMONT 19... for hot and cold water rods and plungers; low and intermediate steam rods.
BELMONT 30... for high pressure steam rods, expansion joints, air, and gas.
BELMONT 6102... for rod and valve stems handling volatile distillates.
cut equipment "down-time" with...
BELMONT PACKINGS

BETTER SEALING...LONGER LIFE

• Idle equipment affects production schedules . . . influences product quality and many times cuts deeply into profits.

To keep equipment producing, use Belmont, the Packings that have individual characteristics and are scientifically designed and constructed by packing specialists to seal better and last longer.

Easy to get . . . Belmont Packings are stocked by local distributors in every large industrial center. Or, if you have a problem that requires special engineering attention, write direct.

Catalog #40 is available, write for it.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

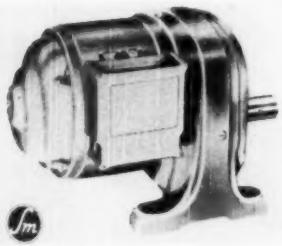
THE BELMONT PACKING AND RUBBER CO.
Butler and Sepviva Streets
Philadelphia 37, Pa.

4 K I A

Steam • Water • Oil • Gas • Air
Acids • Alkalies • Ammonia

Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.



CAPACITOR MOTOR **P1253**

Single-phase gear-head motors with single- or double-reduction gears provide speeds from 780 rpm to 30 rpm in ratings of ½ to 3 hp, inclusive.

Recently designed starting relay is used in place of conventional centrifugal switch. This device eliminates rotating mechanism, such as throwout switches. In addition to this design, these motors have all the advantages incorporated in existing 2- and 3-phase *Klosd* line of motors.

Sterling Electric Motors, Inc, 5401 Anaheim-Telegraph Rd, Los Angeles 22, Calif.

OIL-RESISTANT INSULATION **P1254**

Geotrol is designed for wiring in refineries, or wherever oil or products are likely to cause deterioration of nonresistant wires. Elimination of lead covering saves cost, weight and installation time.

Conductors are insulated with a vinyl compound sheathed in a jacket that is highly resistant to petroleum products. The insulated conductors are available in black, white, red, green, orange, blue and yellow. *Geotrol* is available with solid conductors in sizes 14, 12 and 10 Awg.

General Electric Co, Bridgeport 2, Conn.

BALANCED HAMMER **P1255**

Longer handle, shaped hand grip, *Softip*, balanced hammer has renewable copper, brass or plastic tips or solid copper, or both, brass and plastic heads. Its size ranges from ¾ to 1½ in. dia, weighs 3 oz to 2½ lb.

Gregory Tool & Mfg Co, 25946 West 7 Mile Rd, Detroit 19, Mich.

UTILITY DRILL **P1256**

Lightweight, 19-lb, multi-purpose, utility drill, S17, comes in a handy carrying case with a complete kit of drill accessories including a 14-in. steel drill and three assorted-size rock bits, a star-drill adapter and 25 ft of air hose.

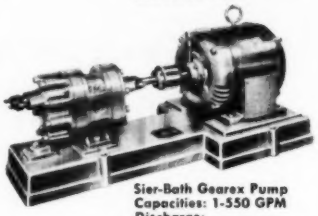
Gardner-Denver Co, Quincy, Ill.

ROOM CONDITIONER **P1257**

Where each room must be controlled individually these two new one-room air

SIER-BATH ROTARY PUMPS for uninterrupted service

Sier-Bath Screw Pump
Capacities: 1-700 GPM
Discharge:
1000 PSI for viscous liquids
250 PSI for water



Sier-Bath Gearex Pump
Capacities: 1-550 GPM
Discharge:
250 PSI for viscous liquids
50 PSI for water

Maintenance—not price—is the true measure of the cost of a rotary pump. That is why Sier-Bath Rotary Pumps are designed to provide uninterrupted, maintenance-free service.

Features that make Sier-Bath Screw Pumps and Gearex Pumps top performers at all times include:

No metallic contact between rotors.
External bearings for handling non-lubricating liquids.
Low pressure on stuffing boxes reduces packing maintenance.
Direct connected to motors at standard speeds up to 1800 RPM.
Available in corrosion-resistant alloys.

Write for descriptive bulletin.

Also manufacturers of Sier-Bath Precision Gears and Sier-Bath Gear Couplings.

FOUNDED 1905 MEMBER A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.

9254 HUDSON BLVD., NORTH BERGEN, N. J.

YOUR MOST PRACTICAL ANSWER IS RIC-WIL INSULATED PIPING SYSTEMS

Ric-wiL Prefabricated Insulated Piping provides several specific advantages to everyone engaged in planning, construction, and operation of structures requiring insulated piping distribution systems.

Architects and engineers profit from the complete Ric-wiL Piping Engineering Service which provides them with accurate system plans, simple specifications to meet every condition, and technical information backed by 40 years' piping experience.

Contractors benefit from exact pipe costs and field fabrication economies made possible by Ric-wiL prefabricated and sealed straight sections and accessories.

Owners and users profit from the high thermal efficiency and long maintenance-free operating life of Ric-wiL Systems, made possible by 40 years of experience exclusively in insulated piping.

These advantages and many others, including financial responsibility, make Ric-wiL your most practical answer to insulated piping problems.

At your request, the Ric-wiL representative nearest you will provide detailed technical information on your specific problems.

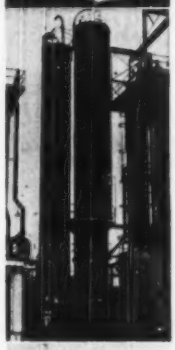
For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 5-JA in Cleveland, Ohio.

RIC-WIL
INSULATED PIPING SYSTEMS

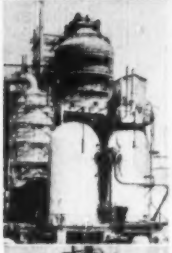
OVERHEAD — **THE RIC-WIL COMPANY · CLEVELAND, O.** — UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

PROVED SUPERIOR IN EVERY FIELD!

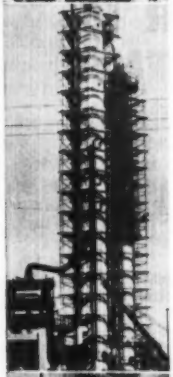


LIGHT-DENSITY TYPE
PABCO
PRECISION MOLDED
85% MAGNESIA INSTALLATION
Reg. U. S. Pat. Off.



THE DEPENDABLE STANDARD... MODERNIZED WITH MANY ADVANTAGES FOR APPLICATOR, ENGINEER, USER

1. Lighter Weight
2. Lower Thermal Conductivity
3. Controlled Uniformity
4. Attractive Smooth Finish
5. Greater "Ductile Strength"
6. Cleaner
7. More Durable
8. Easier To Apply
9. Precision Pipe Fit
10. Simplified Thickness Standards



Pabco's patented process revolutionizes the natural insulation superiorities of 85% Magnesia. Specify it for your projects.

Write nearest office below for your copy of our new, comprehensive catalog and engineering reference book on heat insulation.

PABCO PRODUCTS INC.
INSUBLATION DIVISION
SAN FRANCISCO, 19 NEW YORK, 16

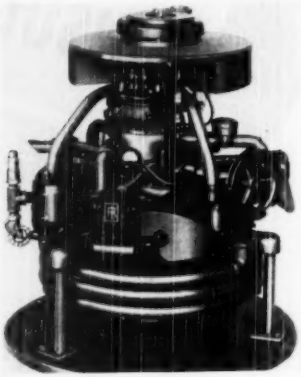
Manufacturers of Heat Insulation
Since 1920

PABCO ENGINEERING SERVICE UNITS IN ALL PRINCIPAL CITIES

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

conditioners in the RVY series, the "300" and "500", tie in well with a central system. The "300" handles from 200 to 350 cfm, the "500" from 350 to 600 cfm. Conditioners consist of finned cooling and heating coils, a drip pan, a standard casing that can be omitted for concealed installations, two double-width inlet fans, fan motor, filter and insulation.

Worthington Pump & Machinery Corp, Harrison, N. J.



PORTABLE AIR COMPRESSOR **P1258**

Weighing 265 lb this portable compressor has a capacity of 36 cfm. It is 32 in. high and is mounted on a 27-in.-dia baseplate. Special wheelbarrow mounting permits moving compressor from one job to another.

Compressor has 6 cylinders, 3 for air, spaced alternately at 60-deg intervals around a vertical single-throw crankshaft. Engine is 4-cycle gasoline unit with overhead alloy-steel valves. Fuel tank has sufficient capacity for 2 to 2½ hr continuous operation.

Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

PROTECTIVE COATING **P1259**

Brush, spray or dip-applied white enamel protective coating, *Prufcoat* BX, is said to be impervious to the strongest cleaning solutions, impermeable to moisture, and to have high impact resistance.

Prufcoat Laboratories Inc, 63 Main St, Cambridge, Mass.

PORTABLE TACHOGRAPH **P1260**

Combining the company's 3-in.-dial, single-spindle, hand tachometer with a precision-recording mechanism gives a compact, portable tachograph. Tachograph draws charts of speed on a traveling paper strip with time marked horizontally and speed vertically.

O Zernickow Co, 15 Park Row, New York 7, N. Y.

(*Continued on page* 190)

another
LIMITORQUE
Advantage . . .

MORE COMPACT DESIGN

LimiTorque Valve Controls are definite space savers because of their extremely compact design and construction. Often they can be installed in "close-quarters" where some other types of valve operators cannot be accommodated.

Remember . . . there are many distinctive construction and operating advantages offered by LimiTorque which assure more dependable and satisfactory performance. We will gladly explain them all.

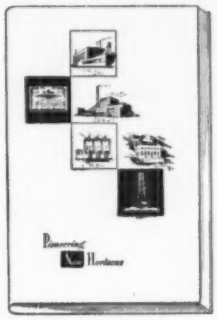
LimiTorque will operate all types of valves through any available power source. Your valve manufacturer can furnish them.

Send for the LimiTorque Catalog. Please make request on your business letterhead.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK · PITTSBURGH · CHICAGO · HOUSTON
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

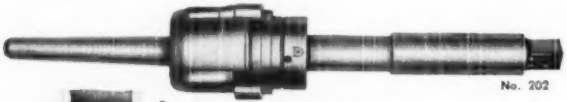


PIONEERING NEW HORIZONS

...an attractive new booklet...

Tells the story of half a century of Engineering Initiative from the design of the world's first electric central station to the first installation of a gas turbine in an electric utility system... Industries generating or making use of power in all its applications will find in it a concise description of the services available from one of America's oldest and most successful engineering and service companies . . . Copies may be obtained by writing—

Pioneer Service & Engineering Co.
231 South LaSalle Street • Chicago 4, Illinois



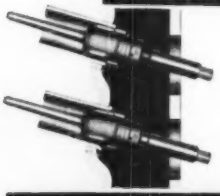
WIEDEKE TRIPLE-PURPOSE

Ideal Tube Expanders for B & W and Similar Boilers

FOR NIPPLES

1. Expander will roll and flare both ends of nipples up to 5" long. Reverse Combination Roll furnished is used when reaching through nipples.

FOR CIRCULATING TUBES



2. Expander for circulating tubes will roll tube parallel and smooth in tube hole and flare projecting tube end in one operation.

3. Expander may also be used with three rolls in frame to roll tube parallel only in tube hole, or as a first operation for extra thick sheets.

See your dealer, or write for Bulletin No. 204-C.

The Gustav Wiedeke Company
DAYTON 1, OHIO

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

DYNAMOMETER **P1261**

This fractional-hp dynamometer is designed to aid in analyzing operation of fractional ac motors and generators. Equipment is also suitable for testing internal-combustion engines and other mechanical equipment of similar rating.

Device is helpful to manufacturers of small machines and motor repair shops in that it gives performance curves on small motors and generators. It is also suitable for checking power requirements of small machines, such as fans, pumps, etc.

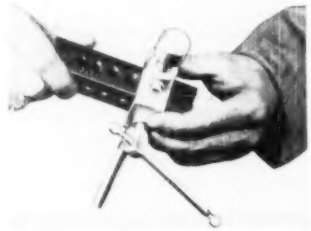
Device is a self-contained unit with extended base to allow mounting equipment under test. Control panel contains instruments for reading field voltage and armature current, a field-control rheostat, and a 3-way switch for selecting desired resistance loads. Device has continuous rating of ¾ hp at 2000 rpm. Maximum possible safe speed is 4000 rpm.

General Electric Co, Schenectady 5, N. Y.

INTAKE SNUBBER **P1262**

Compact, economical, the SOA Series air-intake snubbers, weighing from 110 to 3700 lb snub or check incoming air pulsations so pumping noise is reduced below objectionable levels. Its service is primarily for noise suppression in internal combustion engines, compressors and blowers.

Burgess-Manning Co, Libertyville, Ill.



FLARING TOOL **P1263**

Improved functioning, longer service life are claimed for Model 410 combination tube flaring tool. It combines a flaring pin in a vise slide on a split die block with a series of holes to accommodate ¼, 5/16, ⅜, ½ and ⅝ in. tubing.

Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio.

(Continued on page 192)

WHAT CAUSES TUBE FAILURE?

When deposits are present, tube failure can usually be readily traced to the insulating effect of deposits on tube metal. The *proper* use of the *proper* water treatment will eliminate this problem.

In many cases, however, deposits are not present in failed tubes. Tube failure frequently results from mechanical action . . . poor circulation, steam blanketing, flame impingement, faulty design and similar troubles. In such cases, the cause of the failure often cannot be readily determined and careful investigation is required.

You can't overcome the problem if you don't know the cause!

The Drew System of Water Treatment eliminates guesswork. It starts with proper diagnosis. It includes recommendations for corrective treatment, and other preventive measures such as modification of operating cycles and redesign of equipment, if required. It is specialized service applied to your individual boiler problem.

Don't gamble with guesses! Consult the Drew Engineer or write for further information.

POWER DREW CHEMICALS

Power Chemicals Division

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

DREW PRODUCTS

Nationwide service in Boiler Water and Cooling Water Conditioning

Next time you pay bills for a pier breakdown remember this:

A BERNITZ PIER OUTLASTS FIREBRICK and PLASTIC TYPES 8 to 1

A new spreader-stoker pier—of *any* type—is expensive. But even at that it is the indirect costs of an installation that really hurt . . . the production time lost . . . the fuel wasted . . . the hundred and one "little" things that add up to big bills.

So it's just common sense to figure that the longer a pier is on the job the more you save. And it's figuring like that, that sooner or later is going to lead you to Bernitz "*Carbofrax" Piers. In a spreader-stoker of any type a Bernitz Pier maintains maximum efficiency throughout its long life because slag, clinker and fly ash cannot fuse on its surface. Thus proper shape is maintained, fuel is distributed properly . . . and boilers stay on the job where they belong.

Write or call your nearest Bernitz representative today for complete details on cost-cutting Bernitz Piers.

"*Carbofrax" is the registered trademark of, and indicates manufacture by, The Carborundum Company.

Other Bernitz Products

Bernitz Air-Cooled Furnace Linings • Bernitz-Nygaard Water Wall Armor for Walls and Arches • Bernitz Oil and Pulverized Fuel Burner Rings • Bernitz Water Gas Generator Linings

BERNITZ PIERS PROVEN ON TOUGH INSTALLATIONS. Photo shows an actual setting of a Bernitz "*Carbofrax" Pier. Note complete absence of slag and clinkers on pier and also on sidewall which is made of Bernitz S-100 Blocks.

BERNITZ FURNACE APPLIANCE CO.

89 BROAD STREET, BOSTON 10, MASS.

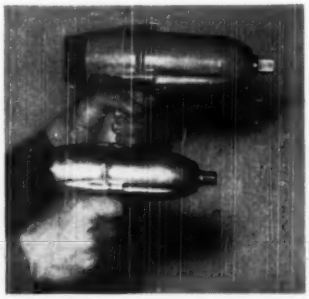
New York — Philadelphia — Syracuse — Atlanta — Pittsburgh — Cleveland — Cincinnati — Detroit — Chicago — Indianapolis — Minneapolis — Kansas City — Reno — Montreal — Toronto — Winnipeg

For further data on items below, use reply cards on page 196a, identifying your request with letter P and number.

BATCH CONTROL **P1264**

Wherever a definite quantity or batch of fluid in a given process must be established the company's new Batch Integrator does the trick. An electrical contact of a make or break design is used. A photoelectric cell pickup unit responds to reflections from a multiface mirror mounted on a rotating integrator shaft. An electric predetermined counter set for the desired quantity of batch of fluid watches the revolving mirror and then deenergizes the pump circuit when that quantity is reached.

Republic Flow Meters Co, 2240 Diversey Parkway, Chicago 47, Ill.



AIR TOOLS **P1265**

Pistol-grip type, air-operated, *Impactools*. Size 504, for nut running up to $\frac{3}{8}$-in. bolt size, and Size 510 for nuts up to $\frac{3}{4}$-in. bolt size . Units have vane-type air motors that enable multipurpose operation such as drilling, step drilling, reaming, tapping, driving screws, hole sawing, broken stud and capscrew removal.

Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

MOVABLE A-FRAME **P1266**

Rugged yet light, movable all-aluminum A-frame with felt-covered bearing surfaces permits moving sheet metal, glass, plastics. Wheels, bearings or skids may be ordered to individual specifications, or frame can be had without wheels.

Tobey Mfg Co, 1221 El Segundo Blvd, El Segundo, Calif.

WELDING GLOVES **P1267**

Three new welding gloves, *A,B,C*, have been added to the company's line. *A* is a soft, rugged carpincho leather with a wool-lined back for maximum heat resistance. *B* has a gauntlet with palm, thumb and fingers of chrome-tanned horsesplit with No. 1 cowsplit back. *C* has a 2-piece, lined leather gauntlet.

Air Reduction Sales Co, 60 E. 42nd St, New York 17, N.Y.

ACID PUMP **P1268**

Air-line pressure pump removes acid and other corrosive liquids from stainless-steel containers. Liquids flow smoothly, stop instantly and come in contact only with a

First commercial ultrasonic testing of HT-HP power piping shows value of method!

For years power engineers have known that alloy power piping might on occasion contain defects which could not be discovered by inspection methods other than radiography. But rather than adopt the virtually prohibitive expense of radiographing complete lengths of pipe, designers specified relatively high safety factors.

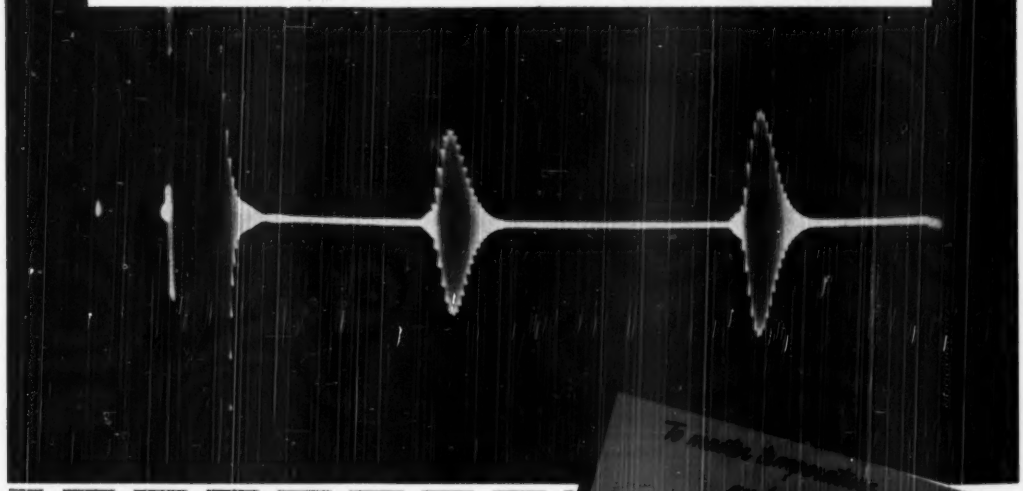
Of course this precaution did not preclude the possibility of defects, and when failures have occured, subsequent investigations have shown that internal cracks were usually the cause of the ruptures.

To meet this problem, investigations were made of inexpensive, non-destructive pipe inspection methods which could reveal hidden defects, and late in 1949, Kellogg, in cooperation with a large turbine manufacturer, presented a practical solution with the introduction of commercial ultrasonic testing of alloy piping.

Ultrasonic exploration of materials, although known for several years, has only recently been attempted on power piping. Indications now are that this technique will prove a successful and low cost means for discovering flaws and, furthermore, for putting a finger on them with startling accuracy. In view of the steadily increasing temperatures and pressures demanded by the economics of modern power generation, the value of this development is obvious.

Specific and continuing studies of this nature are among the many advantages that utility companies gain when they specify high-temperature and high-pressure piping fabricated by M. W. Kellogg.

Illustrated: *Screen pattern on the 'scope of the portable ultrasonic testing equipment currently being used by Kellogg in both shops and field.*



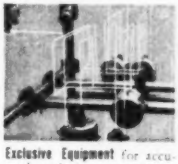
Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

KELLOGG

To make dependable and profitable low pressure piping and process systems

M. W. KELLOGG



Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

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The M. W. Kellogg Company (subsidiary of Pullman Incorporated)—Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

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(SINCE 1915)

Linings for

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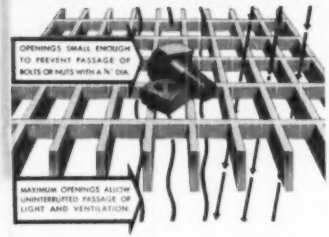
George R. Lewis Co., 1200 Baker Bldg., Minneapolis 2, Minn.
B. H. Mueller Co., 6625 Delmar Blvd., St. Louis 5, Mo.
Ole K. Olsen Co., 823 Perdido St., New Orleans, La.
Philip D. Barnard, 2036 Addison, Houston 5, Tex.
Western Steel Prod. Co., 1755 W. 13th Ave., Denver 4, Colo.

TRI-LOK RECTANGULAR OPEN STEEL FLOORING


OPENINGS SMALL ENOUGH TO PREVENT PASSAGE OF BOLTS OR NUTS WITH A ½" DIA.
MAXIMUM OPENINGS ALLOW UNINTERRUPTED PASSAGE OF LIGHT AND VENTILATION

Tri-Lok strength is obtained by truss action through twisted cross-bar, curved in opposite directions at each bearing-bar. Standard openings in Tri-Lok Rectangular Steel Flooring are $1'' \times 3\frac{7}{8}''$—other sizes can be supplied as required.

Diagonal, or Super-Safety U-type Flooring, and stair treads of all types, are available. Bulletin KF 1140 describes the construction features of Tri-Lok Open Steel Flooring.

The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok grating can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc.

DRAVO CORPORATION

National Distributor for the
Tri-Lok Company
Dravo Bldg., Pittsburgh 22, Pa.
Sales Representatives
in Principal Cities

DRAVO

For more data on these items, use post cards, p 196a. Identify request with P and number.

corrosion-resistant tube. Pump has safety valve to limit air pressure and hold-down clamp to secure it to container.

Lead tubes are suitable for sulphuric, hydrochloric, hydrofluoric and other liquids. *Saran* plastic tubes are recommended where pump is used in nitric, muriatic, citric, phosphoric, acetic, bleaches, peroxide and similar liquids.

General Scientific Equipment Co, 2700 W Huntingdon St, Philadelphia 32, Pa.

SCREW DRIVER P1276

The *Klixon* has a movable clip that slides along the screw blade until its end extends beyond the bit and makes contact with the screw slot. Driver bit is then pushed in. The spring gets a firm grip so screws can be inserted or taken out of places where the hand cannot be used as a guide.

Vaco Products Co, 317 E Ontario St, Chicago 11, Ill.

AIR DRYER P1277

The duties of an aftercooler and a mechanical dryer are combined in the WC-536 seamless-steel-tubing air dryer for compressed-air lines. Unit has a removable inner shell or sheet-metal cartridge packed with *Fiberglas*. Air passes between the inner and outer shells before making its final turn through the *Fiberglas*.

Gasflux Co, Mansfield, Ohio

PNEUMATIC POSITIONER P1278

Grad-U-Motor air piston is suited for damper positioning on diesel-engine air-cooling systems and on pneumatic temperature- and pressure-control systems. Unit has a long stroke and surplus power. Stem travel is confined to about 3 in.

Brown Instruments Div, Minneapolis-Honeywell Regulator Co, Wayne & Roberts Aves, Phila 44, Pa.

BALL-BEARING UNIT P1279

FED Series ball-bearing flange unit has all-metal, 2-bolt housing. It is designed specifically for small-shaft equipment with light loads and normal speeds. Internal self-aligning ball bearings compensate for shaft deflections and mounting inaccuracies. Labyrinth seal eliminates drag and excessive wear.

Headless set screw locks unit to shaft. Standard grease fitting is used for supplementary lubrication.

Ahlberg Bearing Co, 3025 West 47th Street, Chicago 32, Ill.

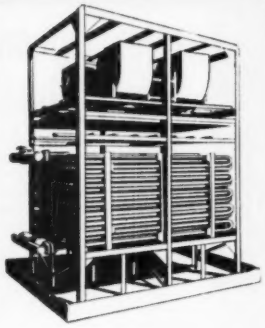
PIPE-CUTTING AIDS P1280

Tool tray attaches to legs beneath power units. Tray with vertical retaining edge holds tool in handy position while working.

Aluminum oil strainer is placed beneath power units over 5-gal pail. Oil and chips drop into strainer, permitting easy disposal and re-use of oil.

Beaver Pipe Tools, Inc, Dane Ave, Warren, Ohio

(Continued on page 196)



How to Improve Operating Efficiency of Evaporative Condensers

SOONER or later make-up water, used in evaporative coolers and condensers, becomes slime laden. Quick remedy is needed here to maintain trouble-free operation of air conditioning equipment. A most effective way to fight slime and side-step trouble is water-treatment with OAKITE SANITIZER No. 1.

This new, germicidal agent of the quaternary ammonium type destroys bacterial organisms and discourages slime growth.

FREE: Handy 20-page Guide contains many practical suggestions on low-cost maintenance of air conditioning and refrigerating equipment. Send for Booklet No. F 7383. No obligation.

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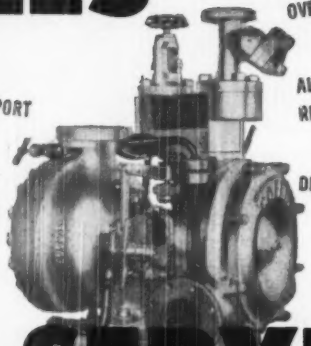

COFFIN TURBO BOILER FEED PUMPS KNOWN FOR DEPENDABILITY and PERFORMANCE

Coffin Turbo Pumps have been specified and used by leading naval architects, engineers, and ship operators for years because they're dependable, compact and *precisely engineered to the job*. Standardized boiler feed units are available in various combinations with the following ratings:

STEAM PRESSURES TO 850 PSI
BACK PRESSURES TO 200 PSI
PUMP CAPACITIES TO 500 GPM
DISCHARGE PRESSURES TO 1100 PSI (Heads to 2500 Feet)
LIQUID TEMPERATURES TO 300°F

Extremely compact, light in weight, and quiet-operating, Coffin Pumps afford minimum steam consumption through high, built-in pump efficiency plus two-bucket row turbine design.

SPECIALIZED MARINE ENGINEERING SERVICE AVAILABLE

Coffin Pumps are sold and serviced by marine specialists strategically located in order to give fast, dependable help on all possible applications of Coffin Pumps. Special "packaged" service and parts depots make faster "turn-arounds" possible and eliminate unnecessary tie-ups while in port.

Write for Bulletin "S"

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San Francisco, Calif.

John H. Marvin Co.
1016 First Avenue, South
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Wilmington, California

MAIN OFFICE & PLANT
THE J. S. COFFIN, JR., COMPANY
326 SOUTH DEAN STREET, ENGLEWOOD, NEW JERSEY

For more data on these items, use post cards, p 196a. Identify request with P and number.

LIQUID SAMPLE COOLER P1269

Stainless-steel, shell and tubular coil heat exchanger of all welded construction employs the counterflow principle to cool boiler and boiler feedwater samples for test purposes. Sample cooler is designed for 1500 psi, 600 F on the cooling-coil side and 150 psi on the stainless-jacket side. It has an outside diameter of 3⅝ in., an over-all length of 11¼ in.; comes in capacities of ¼ and ½ gpm.

Worthington Pump & Machy Corp, Harrison, N. J.

TACHOMETER P1270

Single-range-type hand tachometer, Model JP, has a 3-inch longrange 400-4800-rpm dial with plastic lens.

Herman H Sticht Co, Inc, 27 Park Place, New York 7, N. Y.

PNEUMATIC POSITIONER P1271

Grad-U-Motor air piston is suited for damper positioning on diesel-engine air-cooling systems and on pneumatic temperature- and pressure-control systems. Unit has a long stroke and surplus power. Stem travel is confined to about 3-in.

Brown Instruments Div, Minneapolis-Honeywell Regulator Co, Wayne & Roberts Aves, Phila 44, Pa.

V-Belt Drives

(*Continued from page* 119)

Belt speed in feet per minute is the next factor to find, which is figured by the formula:

$$S = 0.262d \times \text{rpm}$$

Then: $S = 0.262 \times 11 \times 1160 = 3343$ ft per min. From table IV we find that a C-section belt running on an 11-in. sheave at 3000 ft per min is good for 9.2 hp, and at 3500 ft per min, 10.3 hp. At 3343 ft per min this belt would rate about 9.9 hp, which we will use.

Last factor we must know is the arc of contact on the small sheave.

$$\text{Arc of contact} = 180 - \frac{60\ (D-d)}{C}$$

Then: Arc of contact $= 180 - [60\ (30 - 11) \div 27] = 138$ deg. From table II we find that arc-of-contact correction factor for 138 deg is 0.88, the belts running on two grooved sheaves (V to V drive). Then, each belt is good for $9.9 \times 0.88 = 8.7$ hp.

Since the drive is being designed for 36 hp and each belt is good for 8.7 hp, we will require $36 \div 8.7 = 4.1$, or 5 belts. Where the number of belts required is not a whole number, always select the next higher number as we did here. Failure to do this places a higher load on each belt than it is engineered to carry and the drive may

(*Continued on page* 218)

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

BOILERS AND AUXILIARIES

B20 **PACKAGED BOILER** — 8-page brochure describes self-regulating Aerco hot water generator. Operating features, specification table and water capacities are given. Aerco Corp, Englewood, N. J.

B21 **STEAM GENERATORS**—14-page booklet No. B-50-11 points out advantages of the dual circulation steam generator over conventional boilers for power and process steam of super purity. Principles and applications are explained. Foster Wheeler Corp, 165 Broadway, New York 6, N. Y.

B22 **FIRE BRICK**—Single-sheet bulletin outlines properties of Ironton Peerless refractory fire brick which is resistant to slag erosion, clinker action, and abrasive at high temperatures. Ironton Fire Brick Co, Ironton, Ohio.

B23 **REFRACTORY HUNG ARCH**—4-page publication No. 950 describes the Reintjes pendulum action double-hung arch. Also shows the ease of installation and positive locking arrangement between lower and upper tiles, preventing disengagement in service. Geo P Reintjes Co, 2513-19 Jefferson St, Kansas City, Mo.

B24 **CAR SHAKER** — 4-page leaflet features the National car shaker for unloading materials from hopper cars. Several installations are illustrated. National Conveyor & Supply Co, 350 N Harding Ave, Chicago 24, Ill.

CONTROLS, ELECTRIC

D3 **MOTOR STARTERS** — 8-page booklet No. B-4379 presents Slipsyn synchronous motor control for operation and protection of all types of synchronous motor driven. Photographs keyed to line drawings explain operation of these starters and point out their features. Westinghouse Elec Corp, Box 2099, Pittsburgh 30, Pa.

D4 **MAGNETIC STARTERS**—8-page folder No. G-7005 gives ratings, dimensions, engineering and design data on Arrow-Hart's line of magnetic starters and contactors in sizes 0, 1, 2, 3, and 4. Arrow-Hart & Hegeman Elec Co, 103 Hawthorn St, Hartford 6, Conn.

D5 **CONTROLS AND RESISTORS**—Catalog No. 50 contains Clarostat line of resistors, controls and resistance devices. Some of the types featured are: composition-element and wire-wound controls; power rheostats; fixed and adjustable wire-wound resistors; etc. Clarostat Mfg Co, Inc, Dover, N. H.

CONTROLS, MECHANICAL

E9 **LIQUID LEVEL CONTROL**—4-page bulletin No. 1500 tells how to get more water with fewer pump operations from any tank pressure with Autocon Duotrols, the combination pump and air control which holds level accurately and maintains pressure exactly. Automatic Control Co, 1005 University Ave, St. Paul 4, Minn.

E10 **COMBUSTION CONTROL**—Booklet No. CG4752 discusses the company's new Fireye system which provides flame failure protection and programming for industrial and commercial automatic gas burners. Combustion Control Corp, 77 Broadway, Cambridge 42, Mass.

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

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E11 **TEMPERATURE CONTROL**—34-page data book No. 101 is a guide for design and process engineers explaining industrial temperature measurement and control through Partlow mercury-bulb instrumentation. Partlow Corp, New Hartford, N. Y.

ELECTRICAL EQUIPMENT

F33 **LIQUID RHEOSTAT**—Leaflet No. 14S7544 describes construction and operating features of Allis-Chalmers liquid rheostat, Type 257, which provides stepless, wide range speed control of wound rotor motors. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

F34 **PRE-LUBRICATED MOTORS**—4-page folder No. 2201 gives informative data on Reliance pre-lubricated bearing design in electric motors. Contains descriptive sketches, cutaway drawings of improved double shielded bearings and their bracket mounting, etc. Reliance Electric & Engrg Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio.

F35 **COUPLING CONNECTORS** — 4-page catalog section No. 22 covers thermocouple connectors and panels —quick coupling types. Illustrations, details, and applications are given. Therme Electric Co, Inc, Fair Lawn, N. J.

F36 **CIRCUIT BREAKERS** — 8-page booklet No. 3800 describes fully magnetic, non-thermal Aircraft circuit breakers which will operate in a range of -65 to 135 F, vibration proof for 10 G. Heinemann Elec Co, Aero Div, Trenton 2, N. J.

F37 **UNIT SUBSTATION**—8-page bulletin No. 11B7457 features Allis-Chalmers single circuit unit substation designed for practical distribution service and arranged for maximum accessibility and easy maintenance. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

F38 **POWER AND CONTROL CABLES** —60-page catalog gives complete technical data, descriptions, and recommended uses for all Rome power and control cables. Special power problems are given consideration and test data is presented. Rome Cable Corp, Rome, N. Y.

F39 **MOTOR STARTERS** — 12-page booklet No. 14B6419A describes Type H motor starters for 2300-5000-volt squirrel cage, wound rotor, synchronous and multi-speed motors. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

F40 **AIR BREAK CONTACTOR**—8-page folder No. 14B7303 presents the Type 256 air break contactor particularly adaptable for applications requiring frequent starting, inching, reversing, plugging or dynamic braking. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

HEAT EXCHANGERS

G4 **EJECTORS**—12-page folder discusses Conseco steam jet air ejectors for modern, efficient, low-cost air removal from condensers. Principle of operation, engineering data and illustrations are given. Condenser Service & Engrg Co, Inc, Seaboard Trust Bldg, Hoboken, N. J.

G5 **SYNCHRONOUS CONDENSERS** —16-page booklet No. 05B7285 covers the firm's air-cooled, outdoor air-cooled, and hydrogen-cooled synchronous condensers. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

G6 **OIL AND WATER COOLERS**—24-page catalog gives informative data on Conseco Type AL lube oil and jacket water coolers. Materials of construction, engineering data, and illustrations are included. Condenser Service & Engrg Co, Inc, Seaboard Trust Bldg, Hoboken, N. J.

★ **FEEDWATER HEATERS** — 16-page bulletin No. AL-3 contains useful product information about feedwater heaters, heat exchangers, evaporators, pressure vessels and pipe. American Locomotive Co, Public Relations Dept, Schenectady, N. Y. (*Write direct to manufacturer on company stationery giving name and title.)

MAINTENANCE AND SAFETY EQUIPMENT

K14 **CONTINUOUS CENTRIFUGE**—8-page publication features CME continuous centrifuge for fast, continuous, economical separation of liquids from solids and immiscible solutions. Two types of centrifuges, screen type and bowl type, are shown. Centrifuge Mechanical Equip, Inc, 95 River St, Hoboken, N. J.

K15 **TUBE EXPANSION CONTROL**—Bulletin No. 47 describes the Airetool tube expansion control which is now available as a compact, mobile unit providing a convenient way to handle tube expansion equipment. Airetool Mfg Co, 343 S Center St, Springfield, Ohio.

K16 **AIR FOAM** — 24-page brochure discusses air foam for fire-fighting, methods of application, high and low expansion types of foam compound, etc. Pyrene Mfg Co, Newark 8, N. J.

K17 **LUBRICATING OILS** — 12-page pamphlet tells how Sunvis H D 700 oils keep machines clean, prevent rusting, withstand heavy bearing loads, provide long service life, do not foam, and simplify inventories. Sun Oil Co, Philadelphia 3, Pa.

K18 **TUBE ROLLING CONTROL**—8-page booklet gives full description of the John Crane tube rolling control which has been designed as an effective means to accomplish a more uniform holding power of the expanded tube joint and to avoid over-rolling and over-working of ferrous or nonferrous tube metals. Crane Packing Co, 1800 Cuyler Ave, Chicago 13, Ill.

K19 **OILERS' SAFETY CHART**—9x6-in. safety chart for oilers lists 15 "things to remember" when lubricating machinery. Printed on heavy card stock suitable for hanging in a prominent position. New York & New Jersey Lubricant Co, 292 Madison Ave, New York, N. Y.

MAINTENANCE MATERIALS

L29 **ROOF SAVERS**—4-page publication tells how to prolong life of a roof and repair accidental damage. Roof problems are divided into 3 groups: roofs that are starting to dry out; roofs that are dried out and eroded; and roofs and roof structures that are broken. Johns-Manville, 22 E 40th St, New York 16, N. Y.

L30 **INSULATING CONCRETE** — Technical data sheet consists of typical applications of Permalite lightweight, insulating concrete. A mix design data table is also included. Great Lakes Carbon Corp, Building Products Div, 18 E 48th St, New York 17, N. Y.

L31 **PAINT PRODUCTS** — 12-page booklet features paint products for public utilities, electrical manufac-

(*Continued on page 198*)

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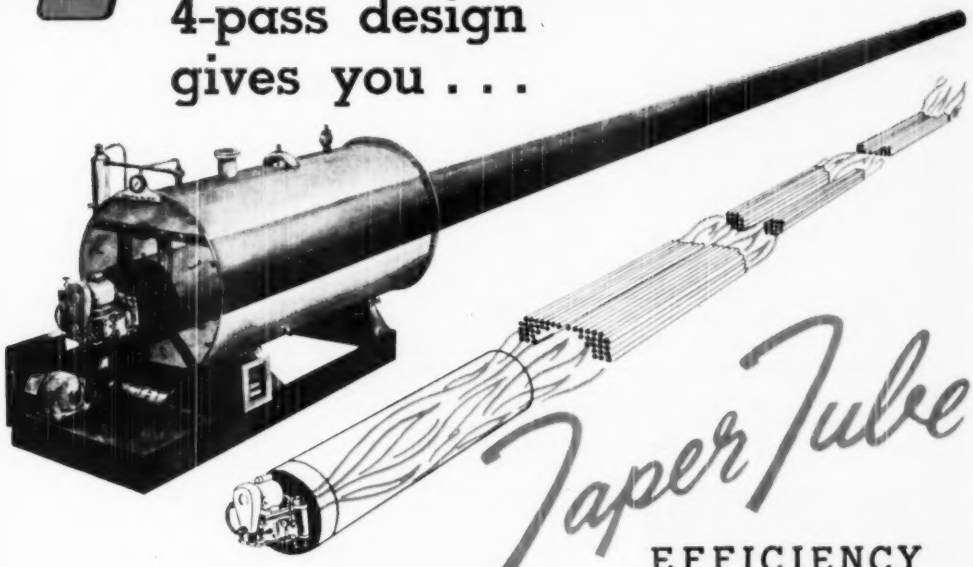
New York 18, N. Y.

HOW SUPERIOR'S 4-pass design gives you . . .



Taper Tube EFFICIENCY

The long-lived efficiency of Superior Steam Generators results from fundamentals of design which are basically sound. Superior's 4-pass, down-draft design provides a minimum of 5 sq. ft. of heating surface for each unit of horsepower rating; **and every inch of that heating surface is effective.**

WHY 4-PASS?

Theoretically (from the standpoint of heat transfer alone) the fire passes of a perfectly designed fire tube boiler would resemble a long, very gradually tapered cone surrounded by water. The large end would be sized in ratio to the volume and speed of the combustion gases so that the gases would be crowded into the tube and thus "scrub" the walls of the tube, forcing contact between fire and tube surface. As the gases give up their heat to the surrounding water (by transfer through the tube) the gases shrink in volume. The gradual taper of the tube compensates for this shrinkage, maintaining the scrubbing action which promotes efficient heat transfer.

Such a fire tube is impractical; but Superior's 4-pass design achieves the same effect. Its 4 passes are so designed that each successive pass has a lesser number of tubes (and hence a smaller area in cross section) for the passage of combustion gases. This is, in effect, **taper-tube** performance which results in the maximum practical efficiency of heat transfer . . . performance which makes it possible for Superior to guarantee **more** than 80% thermal efficiency **under field operating conditions.**

Superior Steam Generators are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up 250 p.s.i. or for hot water.

Write today for the details in Catalog 201.

Superior Combustion Industries, inc.

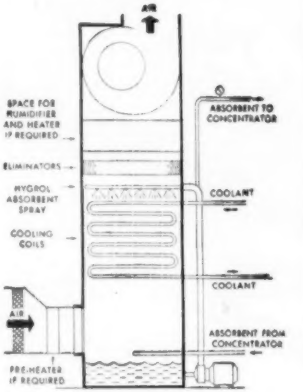
Factory Emmaus, Pa.
Executive Offices Times Tower, Times Square, New York 18, N. Y.

How You Save with the NEW Niagara Method of Air Conditioning

Using "Hygrol" Absorbent Liquid

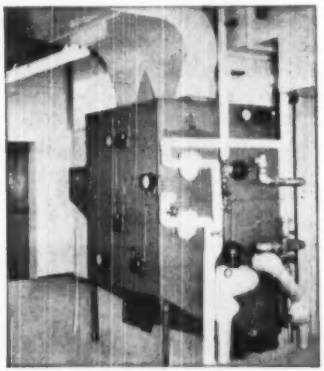
Because it absorbs moisture from the air directly, the new Niagara Controlled Humidity Method uses less, or no, mechanical refrigeration for dehumidifying. You save first costs and installing of heavy machinery. You save space, maintenance expense, power. You get easier, more convenient operation.

Using "Hygrol" hygienic absorbent liquid, this method gives complete control of temperature and relative humidity. Especially, it is a better way to obtain dry air for drying processes, packaging hygroscopic materials, preventing moisture damage to metals, and obtaining better quality for chemical process products and food products—or in obtaining better results in comfort air conditioning for office or laboratory at lower refrigeration costs.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

Food Packaging under Controlled Humidity


Niagara Controlled Humidity Air Conditioner

The diagram shows how filtered air is dehumidified by passing thru a spray of "Hygrol"—a liquid absorbent which removes air-borne moisture. This liquid is hygienic and non-corrosive; it contains no salts or solids to precipitate and cause maintenance troubles. It is continuously re-concentrated at the same rate at which it absorbs moisture, providing always the full capacity of the air conditioner, automatically.

Units provide a range of capacities from 1000 to 20,000 C. F. M. Multiple unit installations are in use successfully. Records of results are available. For further information, write Niagara Blower Co., Dept. **P**, 405 Lexington Ave., New York 17, N. Y.

(Advertisement)

turers, steel fabricators, and industrial maintenance. Contains complete information for application of primers and finishes. James B Sipe & Co, Pittsburgh 16, Pa.

MATERIALS HANDLING

M13 **PORTABLE BELT CONVEYOR**—8-page bulletin No. 374 describes complete range of the Barber-Greene Model 374 heavy duty portable conveyor. Lists fields of use and products handled. Barber-Greene Co, Aurora, Ill.

M14 **PORTABLE CRANES** — Folder No. 28 deals with equipment for vertical movement in both storage and production operations. Stackers, handy hoisters, portable cranes and working height lifters are featured. Lewis-Shepard Products Inc, 258 Walnut St, Watertown 72, Mass.

M15 **FORK LIFT TRUCKS**—4-page leaflet No. M-410 illustrates Mobilift's 2 new 2,000 lb capacity Lev-R-Matic drive fork lift trucks. Model E is an improved, more functional "stand-up" type and the ER is a new "sit-down" type. Mobilift Corp, 835 S E Main St, Portland 14, Ore.

MECHANICAL TRANSMISSION

N18 **SPEED REDUCERS** — 24-page catalog No. 1115 provides information on selection, service factors, dimensions, rating tables, etc, of Falk parallel shaft roller bearing speed reducers. Falk Corp, 3001 W Canal St, Milwaukee 8, Wis.

N19 **COUPLINGS**—6-page folder No. 50 features the firm's new Dihedral couplings designed to handle misalignment up to 7 deg. Diagrams and service factors are given. Ajax Flexible Coupling Co, Inc, Westfield, N. Y.

METALS AND ALLOYS

R3 **CORED FORGINGS**—4-page brochure shows National cored forgings which can be produced by the company in brass, bronze and copper. Advantages are discussed. National Cored Forgings Co, Inc, Connecticut Ave, South Norwalk, Conn.

R4 **HARDFACING ALLOYS** — 20-page catalog contains detailed information on the complete line of Airco hardfacing alloys. Typical uses, mechanical properties, chemical analyses, etc. Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.

R5 **SILVER ALLOY BRAZING**—24-page booklet No. 20 explains silver alloy brazing with Easy-Flo and Sil-Fos. Also tells where and how to use these alloys to the best advantage. Handy & Harman, 82 Fulton St, New York 7, N. Y.

R6 **HARD METAL CASTINGS**—16-page bulletin covers a few of the numerous uses of hard metal castings in various industries. Illustrations of various specimens are included. Stoody Co, Whittier, Calif.

METERS AND INSTRUMENTS, ELECTRIC

S1 **REACTIVE POWER** — 4-page data sheet No. 9.1-3 describes methods for accurate and rapid measurement of useful power with a check on reactive power to prevent overloading of generators. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Roberts Aves, Philadelphia 44, Pa.

S2 **ELECTRONIC INSTRUMENTS** — Bulletin No. W1821 features the firm's new line of Series 500 strip-chart Dynamaster electronic instruments for recording and indicating such variables as temperature, resistance, conductivity, strain, position, etc. Bristol Co, Waterbury 20, Conn.

S3 **THERMOCOUPLES** — 38-page catalog No. TC-8 contains up-to-date prices, application recommendations and pertinent information concerning thermocouples, radiation detectors, resistance bulbs, etc., for indicating, controlling and recording in-

ALLIS-CHALMERS

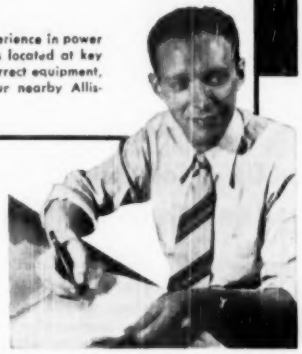
Hot Process—Hot Zeolite SYSTEM

..Offers ALL SIX!

1. Zero hardness	**4.** Low total solids
2. Low alkalinity	**5.** Optimum pH
3. Low silica	**6.** Low CO_2 in steam

PLUS: Simplicity of operation and low chemical costs!

LAWRENCE A. PEDERSEN, with over 17 years experience in power plant water conditioning, is one of the specialists located at key points throughout the country to advise you on correct equipment, chemicals and service. For free survey call your nearby Allis-Chalmers office.



CONVENTIONAL TREATING METHODS seldom produce a completely satisfactory boiler feedwater. Each method leaves power equipment unprotected in some way. Treating equipment selection normally is made on the basis of the *least* harmful effluent.

That is where Allis-Chalmers comes in. We know power equipment because we manufacture it, and we know how vital good water is to its performance. Now we insure that performance by offering the hot process — hot zeolite system, which gives complete control over *all six* critical water conditions.

Only a hot process — hot zeolite system obtains *low hardness* while reducing *alkalinity, silica, solids* and *CO_2 in the steam.* At the same time it raises *feedwater* pH to optimum values. There is no compromise of essentials with this combined treatment. Yet *chemical costs are low,* for only salt and lime are required for operation.

Guard against scale, embrittlement, foaming, carryover, corrosion and excessive blowdown with one system! Investigate the possibilities of hot process — hot zeolite treatment. Write for the free Allis-Chalmers bulletin 28X7559.

ALLIS-CHALMERS A-C

Water Conditioning

✓ EQUIPMENT ✓ CHEMICALS ✓ SERVICE

ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.

Gentlemen:

Please send me bulletin 28X7559.

Name

Title

Company

Address

City State A-3219

Now..
with the
FEED

TYPE 149

Ample Power for Direct Action ...Easily Adapted to Remote Control

You have a leverage ratio of 18 to 1 forming the connection between float and inner valve plug in the valve body of the BS&B-Climax 149 Feed Water Regulator. This means ample power to operate against differentials across the valve as usually encountered. Designed to serve as Feed Water Regulator or as Liquid Level Control. Combines the economy with the proved efficiency of Climax top-and-bottom-guided, reversible valve bodies.

Employ the type 149 float cage for direct control of level, remote of valves or instruments through air pilots, and operation of alarm systems or signals through Mercoid switches. Yes, sir... you can't beat this BS&B-Climax Control for versatility!

For Quick Solutions of Tough Problems, Count on *Climax!*

You'll be amazed at the ease with which a BS&B Controls Engineer can end your control worries. Strategically located, he is always ready to give you complete, understanding service.. in strict confidence. Check the coupon below for the BS&B Controls Man nearest you.

BLACK, SIVALLS & BRYSON, INC.
Climax Controls Division, Section CI-6-12
7500 E. 12th St. Kansas City, Mo.

Send complete information on following items, as checked: ☐ Type 149 Feed Water Regulator ☐ Type 320 Pressure Reducing Regulator ☐ Type 86 Diaphragm Valves ☐ Type 850 Displacement Liquid Level Controllers ☐ Have Sales Engineer call. Also send name of nearest BS&B Controls Man.

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE _____

Models available... in high tensile cast iron for pressures up to 250 psi, cast steel for up to 500 psi.

Complete description, diagrams, specifications and applications are ready for you. Mail the coupon... today!

Climax Controls Division

BLACK, SIVALLS & BRYSON, INC.

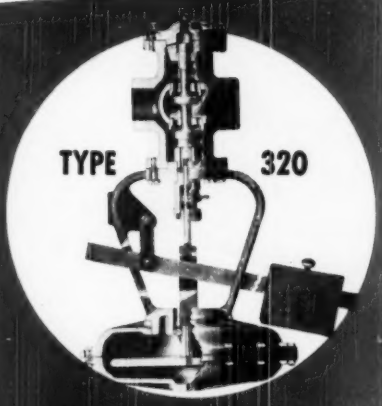
KANSAS CITY • OKLAHOMA CITY • TULSA

Efficiency at a Real Saving

New BS&B Climax WATER REGULATOR

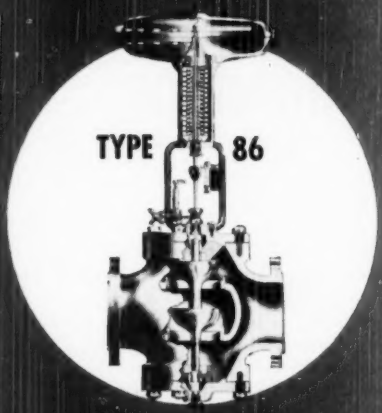
PRESSURE REDUCTION OR BACK PRESSURE REGULATOR

Type 320 Regulators allow sensitive pressure control in vapor-vacuum and low-pressure steam heating systems. Weight loaded, pressure operated, diaphragm actuated. Built for long life under rugged conditions.



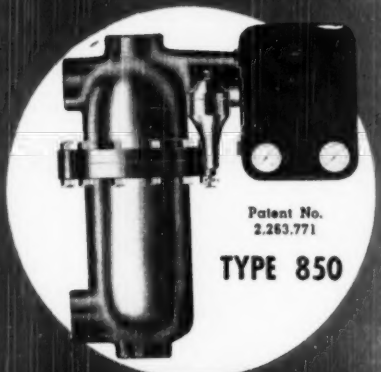
DIAPHRAGM CONTROL VALVE

Type 86 . . famous the world over for high lift, accurate control, ease of maintenance. Fully reversible in the field. Super-polished lower stem for minimum friction. Wide rangeability. Check coupon for catalog.



DISPLACEMENT LIQUID LEVEL CONTROLLERS

No leakage! . . . no stuffing box . . . no friction problem! That's the Type 850, a BS&B-Climax-developed exclusive. Ideal wherever liquid level control involves exacting and wide range control. Shown here with Type 1410 BS&B-Climax Control Pilot. Complete catalog available . . . send coupon now.



struments. Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill.

S4 **INSULATION RESISTANCE**—4-page folder No. 2A gives full data on 29 Vibrotest models, having resistance testing ranges from 100-50,000 megohms, with test potentials from 125-1000 volts dc. Associated Research Inc, 3770 Belmont Ave, Chicago 18, Ill.

METERS AND INSTRUMENTS, MECHANICAL

T20 **PNEUMATIC METERS**—4-page publication, entitled "Pneumatic Transmission Improves Safety in Central Stations," discusses principles of pneumatic transmission, location of transmitter and receiver, equipment required, etc. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Roberts Aves, Philadelphia 44, Pa.

T21 **PIPING METHODS** — 4-page leaflet No. 145 presents Jerguson valves for instrument piping and general use. A few of the typical services where these valves offer advantages are illustrated. Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U33 **STEAM TRAPS**—16-page booklet, Section 12, consists of diagrams and dimensions of Marsh steam traps. Construction and operating details are explained. Typical installations are shown. Marsh Heating Equip Co, Skokie, Ill.

U34 **SPRAY VALVE**—4-page bulletin No. 60 tells about Farval's new spray valve for accurately controlled spraying of lubricants onto open gearing, slide surfaces and other open bearing areas. Farval Corp, 3251 E 80th St, Cleveland 4, Ohio.

U35 **CORROSION-RESISTANT VALVES**—4-page brochure No. 5 gives informative data on corrosion-resistant valves. Aloyco Teflon seated valves, needle, plug gate and sampling valves are shown. Alloy Steel Products Co, Linden, N. J.

U36 **CONTROL VALVES** — 4-page folder No. 810 describes the K & M Series 1200 and 1400 diaphragm control valves. Cut-away view explaining features, as well as a dimension table are included. Kieley & Mueller Inc, 2033 42rd St, North Bergen, N. J.

U37 **SPROCKET RIM**—4-page leaflet points out advantages of Babbitt adjustable sprocket rim with chain guide for operation of overhead or inaccessible valves, and hopper devices, from floor. Babbitt Steam Specialty Co, New Bedford, Mass.

U38 **STEAM AND AIR TRAPS** — 4-page bulletin No. 101 contains complete information on Squires steam and air traps for pressures up to 600 lbs. Capacity tables, sizing information and installation data are given. C. E. Squires Co, 18502 Syracuse Ave, Cleveland 10, Ohio.

PUMPS

W17 **CENTRIFUGAL PUMP**—8-page booklet No. 1001 gives a complete description, cross-section drawing, rating tables and dimension print of the firm's new Type GS centrifugal pump. All parts of the pump except the bare pump casing are contained in one easily replaceable rotor assembly. De Laval Steam Turbine Co, Trenton 2, N. J.

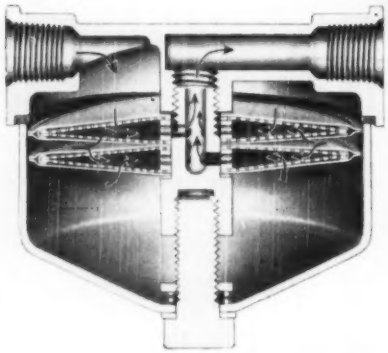
W18 **SEWAGE EJECTOR SYSTEM**—12-page catalog No. E-50 discusses the company's pneumatic sewage ejector system. Diagrams and features as well as a partial list of users are given. Blackburn-Smith Mfg Co, Inc, Hoboken, N. J.

W19 **CENTRIFUGAL PUMPS** — 16-page bulletin No. 52B6059G is a handy guide to selection of centrifugal pumps including close-coupled, pedes-

Here's a new FUEL OIL FILTER for gasoline and diesel engines

Exterior view of filter (actual size 4" wide). Approved by Underwriters Laboratories.

Cross section of filter showing flow of oil through rayon covered discs.



SPARKLER MODEL OB

The positive seal of the Sparkler Model OB fuel oil filter prevents by-passing of unfiltered oil, ends all possibility of jets or needle valves becoming clogged by impurities carried in the oil. Even the most minute particles — down to several microns in size — are trapped when oil passes through filtering element made of metal screens covered with special non-woven rayon fabric. Nature of the element is such that it also separates all water from the fuel and holds it in extra-deep reservoir until filter is cleaned.

Model OB secures unusually high flow rates by combining low flow resistance of rayon material with large filtering area provided by each disc's two effective surfaces. Maintenance is simple and only infrequently necessary.

Especially designed for heavy duty service, Model OB has strong cast aluminum alloy body and rust-proofed steel parts. Made in a wide range of sizes for use with gasoline engines of all sizes, and with Diesel engines of all sizes operating on No. 1, 2, or 3 grades of Diesel fuel.

SPARKLER MANUFACTURING CO

MUNDELEIN, ILL.

Manufacturers of industrial filtration equipment for more than a quarter of a century.

tal, double suction single-stage, multi-stage, self-priming, etc, pumps. Head capacity charts and tables for various types of the pumps are given. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

WATER TREATMENT

X14 ZEOLITE SOFTENER — 4-page publication No. 4505 illustrates and describes the Cochrane junior industrial zeolite softener for small boiler and industrial plants, laundries, hospitals, etc, where relatively small quantities of softened water are required. Cochrane Corp, 17th & Allegheny Ave, Philadelphia 32, Pa.

X15 SCALE AND CORROSION PREVENTION—12-page catalog No. 551 covers complete scope of water treatment for every need. Tells what types of treatment are required to prevent scale formation, corrosion, foaming and embrittlement in boilers, etc. Elgin Softener Corp, Elgin, Ill.

X16 PACKAGED BOILER WATER TREATMENT — 4-page folder No. 49 explains the Nalco system designed to offer the protection and security of a complete water treatment program to operators of packaged-boiler installations. National Aluminate Corp, 6222 W 66th Pl, Chicago, Ill.

X17 BOILER DEPOSIT ELIMINATION — Booklet includes pictures, illustrations and comprehensive description of the methods prescribed by the company for eliminating boiler deposits. E F Drew & Co, Power Chemicals Div, 15 E 26th St, New York 10, N. Y.

★ **WATER CONDITIONING** — 12-page brochure, entitled "Water Patrol for Profit Control," reveals the reasons for development of scale in water lines and boilers. Aquatrol Inc, P O Box 12233, Houston, Texas. (*Write direct to manufacturer on company stationery giving name and title.)

X18 SLUDGE CONTACT REACTOR —15-page bulletin No. 5001 describes the Cochrane Liquon sludge contact reactor, a water conditioning apparatus that takes advantage of the well-known chemical principle that previously formed precipitates added in the form of sludge or slurry will accelerate reactions. Cochrane Corp, 17th St & Allegheny Ave, Philadelphia 32, Pa.

OTHER EQUIPMENT

Z31 STEAM UNIT HEATERS — 20-page booklet No. 10 is a second edition of the "Standard Code for Testing and Rating Steam Unit Heaters." Improved testing equipment, instruments and technique have developed through the years and the purpose of this edition is to recognize them. Industrial Unit Heater Assn, 2159 Guardian Bldg, Detroit 26, Mich.

Z32 INSULATION MATERIAL — 4-page folder, entitled "Build and Insulate with One Material," specifically directs attention to the use of Marinite for breechings; for the construction of ovens and driers; and for fireproofing of structural steel. Johns-Manville, 22 E 40th St, New York 16, N. Y.

Z33 STEAM CONDENSERS—24-page bulletin No. 102 consists of an installation section, engineering data, maintenance section and photographs on steam condensers. Steam condenser specialties are also discussed. Condenser Service & Engrg Co, Inc, Seaboard Trust Bldg, Hoboken, N. J.

Z34 WELDING PROCESS — 26-page reprint, entitled "The Aircomatic 'R' Welding Process," discusses the fundamentals of metal-arc transfer in inert-gas-shielded arc welding. Air Reduction, 60 E 42nd St, New York 17, N. Y.

Z35 POWER EQUIPMENT—28-page bulletin No. 25B6150C covers briefly products commonly used on power generating, transmission and distribution systems. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

50 YEAR report to our customers -

FROM DATE OF INCORPORATION ON NOVEMBER 23, 1900 TO DECEMBER 31, 1949

THE COMPANY RECEIVED:			
From customers for products purchased by them		$5,122,702,261	
Dividends received, interest earned, and other income		76,068,236	
Total revenues		$5,198,770,497	
THE COMPANY PAID OUT OR PROVIDED:			
For raw materials, supplies, and services bought	$2,766,354,971		
Provision for depreciation (wear and tear or obsolescence) of plants, buildings, machinery and equipment and for depletion of coal, iron ore and limestone, etc., by mining operations	270,852,769		
Federal, State, local and miscellaneous taxes	267,462,953		
Interest and other costs on long-term debt (including dividends of $27,265,805 paid to preferred shareholders)	117,724,128		
Total costs		3,422,394,821	
Leaving for wages and salaries of employees, dividends to shareholders, and amount required to be retained by company for needs of the business		*$1,776,375,676	100.00%
***OUT OF WHICH THERE WAS PAID:**			
Employment costs (pay rolls, vacations, social security taxes, insurance and pensions paid to or for account of employees)		$1,474,693,687	83.02%
To common shareholders as dividends		125,126,950	7.04
Amount retained in the business for present and future needs and to assure steady work for employees		176,555,039	9.94
Total		$1,776,375,676	100.00%

Your patronage and the American system of free enterprise have helped make this company an important factor in the steel industry. Our future depends on keeping America free, so that any group of citizens may organize a business, at any time--with the expectation that it, too, may grow strong--provide jobs, supply needed products and achieve success in the next 50 years. In the preservation of the American way of life lies our future hope.

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

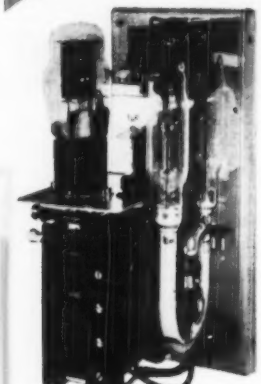
MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.

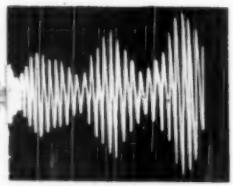
SAVE MONEY ON YOUR LIME AND SCALE PREVENTION JOBS

WITH

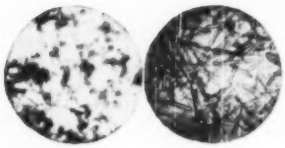
CRUSTEX



the Ultra-Sonic Wave-Producing Apparatus for removing and preventing formation of solid lime stone crust



Oscillograph (27,000 oscillations per second) shows impulses communicated to liquid mechanically to prevent formation of solid crust.



BEFORE: Microphotograph of sample of water before treatment with CRUSTEX, showing solid crust on walls of container.

AFTER: Showing effect of ultra-sonic waves in separating particles of lime where they fall on bottom of container and are easy to remove.

This method of handling a difficult, complicated problem has been proved over a period of years in everyday service to be absolutely effective and foolproof. As evidence of the *proved* performance of CRUSTEX, we offer the apparatus on a trial basis, with a money-back guarantee that it will prove itself in operation in your plant under your conditions.

CRUSTEX Apparatus is simple to install and reasonable in price. It can be depended on to save fuel, prevent damage to boilers and other apparatus and eliminate periodic control of limestone by chemical or other methods. Its operation requires no attention whatsoever. It is highly recommended for its effectiveness in steam boilers, electric boilers, water heaters, industrial washing machines, air conditioning plants, in fact wherever limestone deposits are sources of trouble and expense. Easy to install . . . low in operating cost.

NEVER AGAIN!!

Ask for illustrated literature containing full information. Get full details on our MONEY-BACK GUARANTEE.

VELAN ENGINEERING CO.

Manufacturers of VELAN STEAM TRAPS with "PICTURE WINDOWS"

1 Exchange Place, Jersey City, N. J.

1216 Drummond Street, Montreal, Canada

(*Continued from page 166*)

searches, Inc, and W H Kidd, W H Kidd & Co. This paper treats the relationship of the control valve in an automatic-control process to the controller and the process itself. It compares graphically the effect of three types of control valves on process flow at varied positions of the same controller. Valves discussed are (1) *linear valve* where the effective port opening is directly proportional to the stroke or movement of the actuating mechanism (2) *V-port* or *parabolic valve* where effective port area is a linear function of the square of the stroke of the stem or motion of the actuating mechanism and (3) the *exponential* or *logarithmic valve* (sometimes called the equal-percentage valve) where equal changes in stroke cause equal percentage changes in the effective area for all valve openings.

Charts included in the paper compare the effects of equal stroke changes on valve opening, flow, upstream pressure, pressure drop across valve and downstream pressure for the three types of valves to show range of conditions for which each type is most effective. *ISA paper No. 50-1-1.*

NONMATHEMATICAL DISCUSSION OF FLOW MEASUREMENT, *by J B McMahon, Republic Flow Meters Co.* Purpose is to promote greater understanding of theory and operation of commercial methods of measuring flow. Commercial flow measurement involves (1) changing velocity in a flowing stream by inserting a contraction in the flow line (2) determining the relation between the pressure differential so created and quantitative flow rate (3) measurement of the differential pressure so created and (4) interpretation conversion of measurement into desirable or usable values.

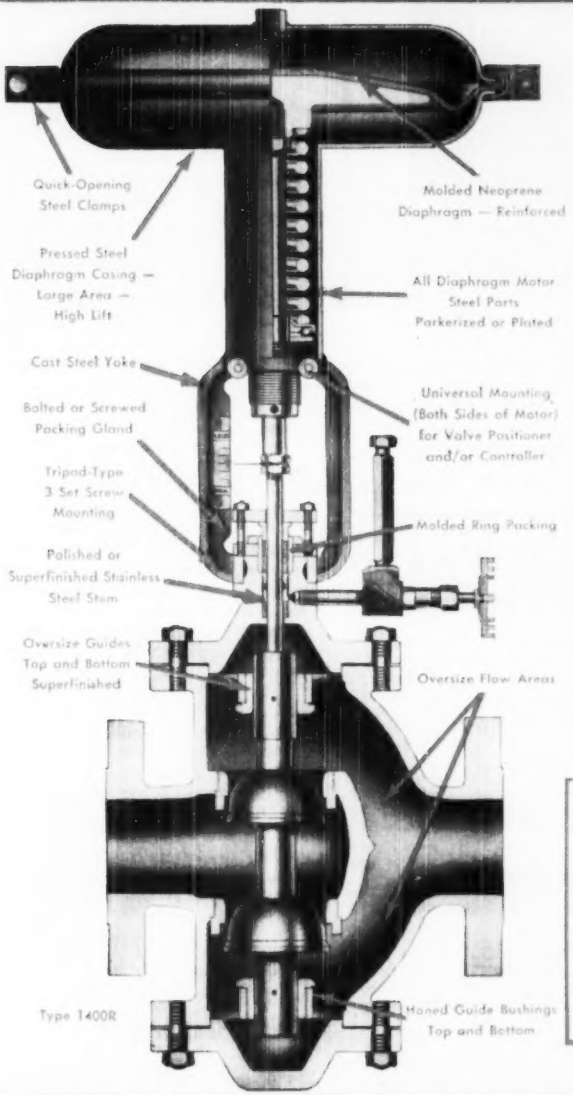
Discussed in turn in simple language are the orifice, flow nozzle, pitot tube and venturi tube, plus a brief discussion of various types of reading instruments. An interesting introduction briefly traces the history of the orifice meter from the time of the Chaldeans in Asia Minor and Mayan Indians in Central America to the present. *ISA paper No. 50-7-4.*

Gas Turbines

CONVENIENT GAS PROPERTIES AND CHARTS FOR GAS-TURBINE CALCULATIONS, *by Chapman J Walker, General Electric Co.* A systematic compilation of properties of air, combustion gas, and other gas-turbine fluids was needed when the author's company intensified its engineering in gas turbines in 1940. This compilation had to be made convenient for everyday use both in turbine and compressor calculation as well as gas-turbine cycle analysis.

At about this same time a large

K&M ADVANCED-TYPE VALVE FOR EXACTING CONTROL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Pressed Steel Diaphragm Casing — Large Area — High Lift
Cast Steel Yoke
Bolted or Screwed Packing Gland
Tripod-Type 3 Set Screw Mounting
Polished or Superfinished Stainless Steel Stem
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Type 1400R
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All Diaphragm Motor Steel Parts Parkerized or Plated
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K & M Diaphragm Control Valves embody the accessibility and other desirable features of the "open yoke", formerly available only in cast iron construction, together with the strength and resistance to shock found only in steel.

The diaphragm casing assembly is the exclusive K & M Boltless Duoseal design which allows quick disassembly. The large diaphragm is molded so there is full effective contact with the diaphragm button during the complete valve stroke. This construction, together with heavy, calibrated, long-travel springs gives an unusually high power factor for extremely precise control.

Flow passages of the valve body have a minimum average area of 140% of comparable size pipe area; inner valve open free areas average 80% of pipe area. This design permits pressure drop to take place principally through the inner valve, assuring complete control over the full valve stroke.

Send for K & M Bulletin S10 for details and data.

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Available sizes — ½ to 16 inches.

Construction — Cast iron, carbon and stainless steels and most machineable alloys.

Inner Valves — A wide range of styles and characteristics to meet varying requirements.

Action — Designed for direct or reverse action.

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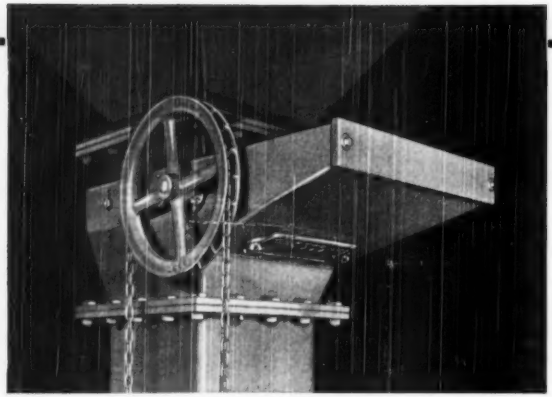
The modern K & M line includes Diaphragm Control Valves, Liquid Level Controls, Pressure Pilots and related equipment for steam, gas, air, oil and liquid service. Ask for K & M catalogue 47.

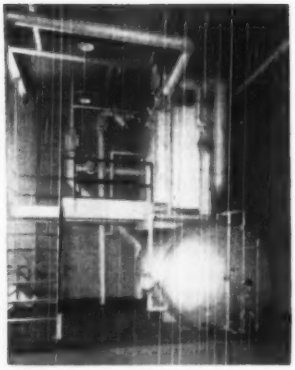


S-E-CO. COAL VALVES will not stick in operation because the S-E-Co. U-shaped gate, together with the double rack and pinion and roller bearing rollers, allows the valve to operate easily regardless of the corrosive and dusty condition that exists within the body of the valve. For a coal valve that will open and shut when required, use a S-E-Co. Valve.

Bulletin upon request.

STOCK EQUIPMENT COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

HOPPES FEEDWATER HEATERS



Deaerating feedwater heater serves as condensation return point for trapped and pumped returns from heating system

DEAERATING:
For medium and high pressure Central Stations; modern Industrial and Process Plants; Steam Heating Plants and all Modern Power Plants which have boilers operating at medium and high pressures.

NON-DEAERATING:
For Laundries; small Industrial Plants; Institutions and all smaller Power Plants where boilers are operated at lower pressures and where economy of investment is desired.

PLATE TYPE:
Deaerating heaters of plate type are designed for capacities up to 85,000 pounds per hour. Non-deaerating heaters include capacities up to 120,000 pounds per hour.

CAST IRON:
(Integral Unit) Designed to meet space limitations, their outlet capacities range from 5,000 pounds per hour to 15,000 pounds per hour.

STEEL TYPES:
These heaters are more diversified and are obtainable as follows—Vertical or Horizontal heaters with integral storage; vertical heaters mounted on vertical storage tanks; vertical heaters mounted on horizontal storage tanks and horizontal heaters mounted on horizontal storage tanks.

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Hoppes engineers work with you to assure that your individual and specific requirements are provided for in full. Let's talk it over—get the economy angle.

HOPPES MANUFACTURING CO., Inc.
Established in 1881
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amount of spectroscopic specific heat data became available and furnished the basis for temperature-enthalpy and pressure ratio-isenthropic energy relations. Chief need was for a system of calculating and plotting the data in a convenient form with the required accuracy.

Author presents the charts developed with the above background in the hope others will find them valuable. Charts are given, units explained, certain calculations developed, and suggested uses of curves offered. *ASME paper No. 50-F-28.*

COMBINED STEAM AND GAS-TURBINE PROCESSES AND APPLICATIONS, *by W M Rohsenon and G H Bradley, Jr, Mass. Institute of Technology.* As the gas turbine grows in importance it becomes increasingly necessary to analyze it as it might fit in with many different component parts in performing some useful function. Factors such as size, weight, efficiency and initial cost all influence such an analysis. Further, limits of the components must be thoroughly known and understood.

Present investigation described by the authors is an analysis of gas-turbine processes making use of water in various ways. The first investigated is the ordinary gas-turbine power plant. Air enters the axial-flow compressor where it is compressed to the desired pressure, which must be within the temperature limits of the metals. From the compressor it goes through a regenerator where it receives heat from the gas-turbine exhaust to the combustion chamber where it mixes with liquid fuel and burns. Ratio of air to fuel determines the temperature to which the working fluid is raised. It then expands to atmospheric pressure through the turbine and exhausts to the regenerator to heat up incoming air.

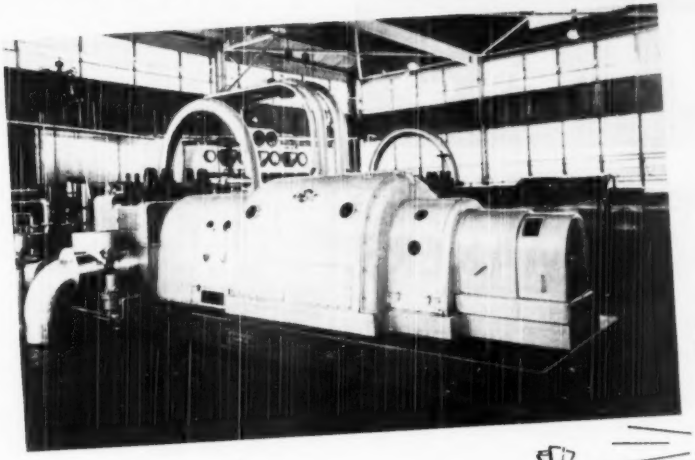
Second process to be investigated was the combined steam and gas-turbine process. Authors describe the elements involved and the process. They do the same for a third and last arrangement, the gas-turbine process with water injection in the combustion chamber. Results for all investigations are plotted and discussed. *ASME paper No. 50-F-23.*

Steam Generation

INVESTIGATION OF STEAM SEPARATION IN BOILER DRUMS THROUGH STUDIES ON A MODEL, *by Erich A Faber, Univ of Wisconsin.* Present trend of increasing the output, operating temperature and pressure of steam generators or boilers has caused steam separation to become a leading problem in steam generation.

Any changes in existing design are costly. So before any are made the

HANDLING TWO JOBS AT ONCE...



and saving money on both!

Two 1500 KW Worthington turbine-generators, installed in the Eunice, N. M. plant of the El Paso Natural Gas Company. These are non-condensing extraction turbines designed to operate on initial steam conditions of 575# — 575° FTT exhausting at 5#G back pressure.

Worthington Turbine-Generators Selected By Natural Gas Firm For Both Power and Product-Conditioning

Pumping natural gas from southeastern New Mexico and the Texas Panhandle to points in California and Arizona, the El Paso Natural Gas Company uses Worthington Turbine-Generators for double duty. Besides furnishing electricity for the company's plant in Eunice, N. M., the turbines automatically extract steam at 125#G for heating Amine solution, which is mixed with the gas to remove impurities.

In every branch of industry, users are getting daily proof of the outstanding flexibility of Worthington Turbine-Generator Sets — not only as sources of more dependable, more economical electric power, but as cost-cutting suppliers of processing steam for many important allied purposes.

WORTHINGTON TAKES ALL THE RESPONSIBILITY

Worthington builds Turbine-Generator Sets in sizes up to 10,000 kw, and in all types. Each is designed to make steam do more work, and each is backed by Worthington's undivided responsibility for the complete unit's design, assembly and performance. For expert aid in selecting the *right* size and type for your own requirements . . . and further proof that *there's more worth in Worthington* . . call our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

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STEAM TURBINES

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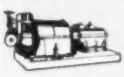
A GREAT TEAM IN STEAM

Feed Water Heaters



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They are all hydraulically operated. Their cost is extremely low when compared with the amount of fuel they save. They are easy to install and operate for years without any attention. The amount of water they use is amazingly small—so small in fact that the discharge can be piped to the ash pit where it will keep the ashes properly damp. The cost of this water should be no more than 2 or 3 cents per week. No other heating attachment gives the same fuel economy as can be obtained by a good damper regulator.

TAKE, FOR EXAMPLE, ATLAS DAMPER REGULATOR No. 502

shown above. This is our "Medium Pressure" Regulator, suitable for boiler pressures up to 150 lbs. per sq. in. It, of course, is hydraulically operated and is equipped with a compensating attachment that is simple and mechanically correct. This permits the regulator to gradually move the damper on boiler pressure changes of a pound and to hold the damper stationary in a partly open position when there is no change in the boiler pressure.

Pilot Valves used with ATLAS Regulators have single seats and are seated by the water pressure which makes them easy to keep positively water tight. They are so designed that the slightest change in boiler pressure is sufficient to open or close them, thus causing the regulator to move the damper in either direction and keep the boiler pressure within the desired close range.

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author decided to set up a model by which performance of drum internals can be compared and predicted.

In producing similar conditions in a model and its prototype it is seldom possible to have complete similarity as indicated by equal values for each dimensionless ratio involved. This investigation required a compromise in obtaining similar conditions. *ASME paper No. 50-F-25.*

TREND OF POWER-PLANT PRACTICE IN GERMANY, *by L F Musil, Styeran Hydro and Electric Power Co, Graz, Austria.* Over a 30-year period from 1915 to 1945 average station heat rates improved from 24,000 to 11,550 Btu per kwhr. Latter figure applies to plants near a natural supply of condenser cooling water. For plants requiring artificial cooling, corresponding rate is 11,700 Btu per kwhr. These rates are based on net energy delivered to the transmission lines.

Coal in Germany has deteriorated since prewar days. As a result installation and operating costs have increased and efficiencies decreased. This is mostly due to the low heat value, high ash and moisture content of the fuel, as high as 40 and 65%, respectively.

Selection of power-plant sites has been determined to an increasing extent by nearness to mines. It costs much less to transmit electrical energy than to transport inferior coal.

Suitable supplies of condenser cooling water are hard to find. As a general rule they are not available in mining areas. As a result, it is usually necessary to employ artificial cooling.

Disposal of huge amounts of ash presents a difficult technical and economic problem.

Use of inferior coals has increased the importance of flue-gas cleaning. Before World War II the electrostatic method predominated. Since then improvements in mechanical-type flyash collectors have led to their widespread use. Two are highly regarded: (1) Vortex sieve developed by Professor Feifel (2) cellular collector built by Rothemuele. These types are illustrated. *ASME paper No. 50-F-21.*

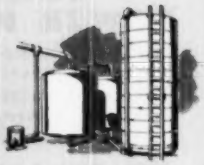
USE OF TUNGSTEN CARBIDE IN COAL PULVERIZERS, *by Wayne C Rogers, Riley Stoker Corp.* A substantial amount of the total coal used yearly in electrical-energy production is burned in pulverized form. Advantages of this type of firing are offset somewhat by large initial capital investment required, plus the inherently high cost of operating and maintaining the milling equipment.

This paper describes the application of an extremely wear-resistant material, tungsten-carbide, as a protective coating for pulverizer grinding elements subject

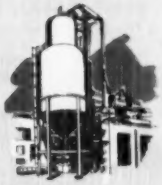
five basic power plant processes...

ZEO-KARB SOFTENER The Permutit Zeo-Karb® Softener removes both hardness and bicarbonates from raw water. The effluent is soft and reduced in total solids and alkalinity. The sulphate-carbonate ratio may be adjusted as desired by a system of mixed effluents.

SILICA REMOVAL PLUS DEMINERALIZATION Demineralization by cold ion exchange processes produces water of comparable quality to distilled water at a small fraction of the cost of distillation. Treatment by an anion exchange resin, Permutit S,® reduces silica to less than 0.5 ppm.



DEAERATING HEATER The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers by removing *all* oxygen and free CO_2. Capacities from 12,500 to 1,400,000 pounds per hour are in service.



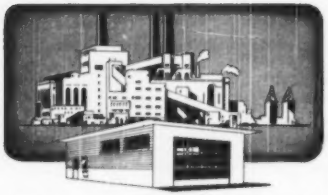
SLUDGE BLANKET HOT LIME SODA The application of the sludge blanket design to hot lime soda treatment gives you soft water of a low silica content. Lower turbidity eases the load on the filters... savings in operating costs are substantial.

PRECIPITATOR The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity. It can also be used to reduce silica.

Consult Permutit without obligation on any of these processes. Our know-how, in water conditioning, backed by 37 years experience, can provide the answer to any water treatment problem. Write to The Permutit Company, Dept. P-12, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.

Permutit

Water Conditioning Headquarters For Over 37 Years



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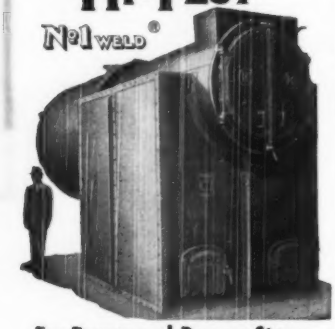

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to wear and replacement.

Pulverizers using this equipment, which have together ground upwards of a million tons of coal, show a significant decrease in maintenance costs. Pulverizer designs, modified to take full advantage of the properties of tungsten-carbide now in the field, give evidence that further reductions may be expected as well as lower power requirements. *ASME paper No. 50-F-22.*

PLANT PROBLEMS

(*Continued from page* 132)

Feed to Condenser Bottom

THIS SETUP will work smoother if make-up line feeds into bottom of condenser instead of exhaust neck. Outlet from control valve will be sealed, reducing sudden drop in pressure.

Dismantle valve during weekend shut-down and closely inspect stem, both seat rings and valve disks. Look for leaks between threads or blow holes between seat bridges. These may cause unbalance. Also check float to see it isn't waterlogged, off the stem, or stiff in the lever bearings.

VINCENT STROJSA *Glace Bay, N.S.*

Bypass Float Valve

INSTALL A small bypass valve around the float valve so it is tightly closed or open enough to forestall chattering. Or a small float valve operating at a slightly different water level may be tried.

Remember, a small pressure change causes flashing. Check to see that float valve doesn't chatter when nearly closed. *LN*'s diagram indicates this may be happening.

W W MONTGOMERY
Des Plaines, Ill.

Check Float Valve

FLOAT VALVE seems to be cause of trouble. It looks as though valve is loose, loose fitting in its guide, or the float connection allows too much play. On changes in vacuum or during feeding of condensate, pressure difference causes valve chatter and may start hammer.

Small movement of float that stops hammer indicates looseness. Or one valve may be partly open when it's supposed to be closed and pressure difference causes hammer. Inspect valve again and see that only one valve is open on either extreme of float movement. Adjust movement to change from one opening to the other as quickly as possible.

Stopping hammer by throttling valve *A* indicates change of pressure difference and equalizing it to stop noise.

GEORGE GRIFFEL *Bronx, N.Y.*

(*Continued on page* 212)

Assures Positive Distance Reading of Liquid Levels

JERGUSON TRUSCALE GAGE

THE modern design JERGUSON TRUSCALE GAGE gives new accuracy for reading of liquid levels in boilers, deaerating tanks, etc.

Here is the distance reading gage which incorporates all of the newest engineering features! The Jerguson Truscale has exceptional sensitivity, with the ability to register changes as small as ½ of 1% of range! The translucent dial scale is clearly lighted from behind, and is easy to read.

The Truscale Gage may be equipped with positive alarm system. Lights flash and horns sound at specified key points when liquid level falls dangerously low or rises too high. Foolproof anti-surge mechanism for use on ships. Available for panel, pedestal, or wall mounting. It will pay you to investigate.

JERGUSON TRULEVEL GAGE

Hydrostatic type distance reading gage with inverted U-tube manometer. Water level always visible with space above showing brilliant red. Built-in feature makes possible checking of gage accuracy in few seconds.

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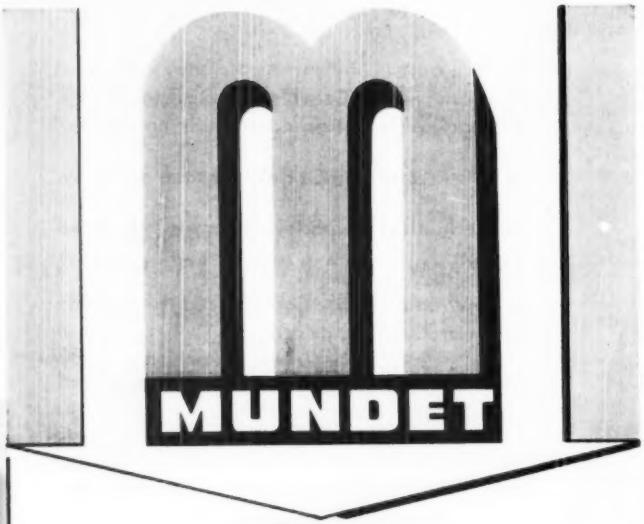

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Hammer Is Near Heater

WHEN WE PUT our 25,000-kw unit in operation last year we had severe hammer in condensate-pump discharge line. Hammer occurred when recirculating valve allowed too much water to pass from condensate line. Steam from the deaerating heater backed down into the condensate line because all condensate was recirculating.

We eliminated this condition by installing an air-operated float valve in place of the mechanically-operated float control valve. Greater stability in control of hotwell condensate level was obtained.

Install a check valve in condensate line where it enters the deaerating heater. This may eliminate hammer by preventing steam from backing into condensate line when there is no flow. Water hammer may appear to be occurring in discharge side of pump but is actually in condensate near heater.

H C LUFF, W K ROWLEY
Orlando, Fla.

Air-Balance Connection

AIR-BALANCE CONNECTION between control valve and condenser may be too small or partially clogged. If this is the trouble, and there's a change in vacuum, balance between pressure at valve and in condenser may be destroyed. Then there will be a rapid flow of water from condenser to valve or in reverse direction.

If there was a sudden increase in vacuum, and air-balance connection was too small for pressure at control valve to quickly adjust itself, condensate would flow from control valve to condenser causing float to drop suddenly. Flow from surge tank through float valve might be rapid enough to entrain some air, causing hammer.

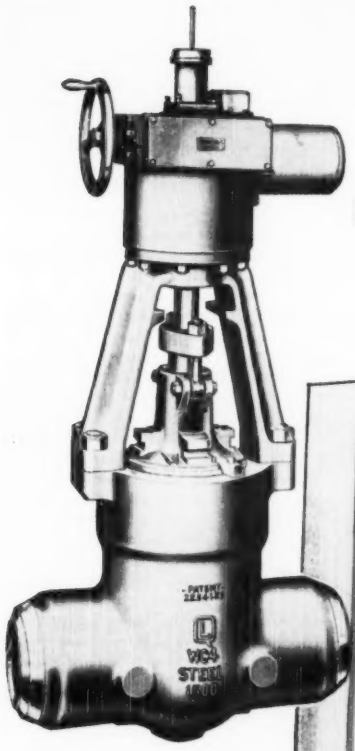
With a sudden decrease in vacuum and too small an air-balance connection, water would flow from condenser to control valve. It might close this valve and cause hammer.

G R COTTINGHAM *Richmond, Va.*

Switch Tank, Check Ejector

TO STOP HAMMERING remove surge tank from float valve and connect to heater with a float valve between. Check water- and air-balance pipes. They should be same size and large enough. Lag of float valve indicates trouble in those connections if valve is OK mechanically. Try to check valve off line under operating temperature and pressure, if possible.

Changes in vacuum show float valve isn't functioning properly. Condensate passes through the ejector on its way to the valve. Change in vacuum varies



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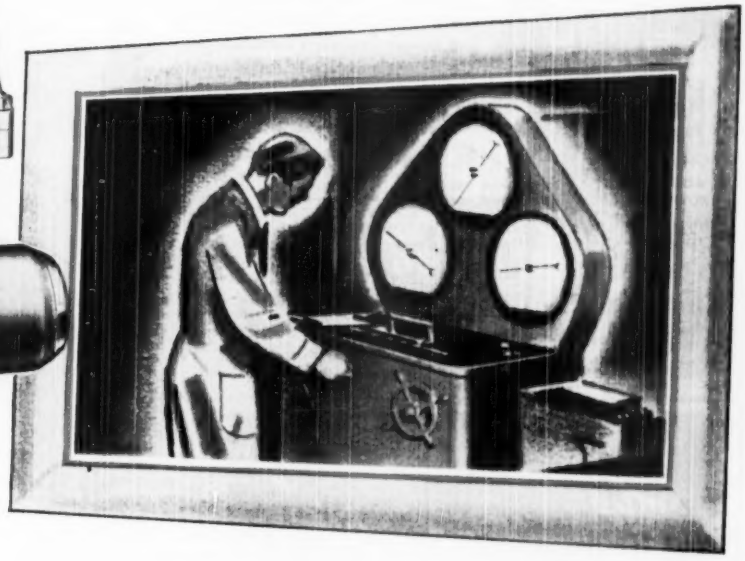

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BOILER TUBE CO. OF AMERICA
McKEES ROCKS, PA. (Pittsburgh District)
PITTSBURGH CHICAGO

water level unless valve has no lag and is extremely accurate.

Check ejector to be sure drain is far enough above high-water level in condenser. Flooding of ejector reduces efficiency and changes vacuum. Test quick-start ejector for air loss.

CLYDE HOWARTER *Canton, Ill.*

Take Out Control Valve

BEST WAY TO OVERCOME difficulty is to take out control valve and connect 1-p feed main direct to surge tank. Hammering and inability to be operated in parallel are weaknesses sometimes found in these valves. Small amount of air in lower balance connection can form a large bubble when pressure is low. This may rise in float chamber and cause float to move violently. Also, valve and float must be accurately balanced; otherwise, with a vacuum on one side of valve and 50-ft head on other, ball may oscillate.

Operate system on the overflowing or recirculating hotwell principle; either of these gives equal or possibly better results than a float valve. If valve is taken out as suggested, connection should be made on discharge side of drain cooler, or preferably after the first 1-p heater where feed temperature is about 150 to 160 F. Run a line from side of surge tank to recirculate about 5% of total consumption of turbine. This condensate is returned to main condenser. With this arrangement condensate pumps deliver more water than needed by feed pumps, and there is continuous recirculation.

Surge tank's lower portion and pipes that connect it to feed pump are kept full of deaerated water by setup described. There is little chance of aerated water entering system.

Run recirculating line to a small tank in basement. Connect basement tank to top of condenser with another line, regulating flow with a float valve in tank. A high-level ball float and valve should also be provided on connection from surge tank to prevent flooding when plant is shut down. Volume of water below leakoff connection should be sufficient to supply all normal demands of boiler including blowdown.

G H MARTIN *Tynemouth, England*

POWER NEWS

(*Continued from page 140*)

Flow Meters Co. has been in the society since 1922, and has worked his way up through various section offices.

Moxley, a graduate of the University of Alabama, has become a vice-president of his company, the American Cast Iron Pipe Co. He has long been associated with ASME activities, having been a member since 1924.

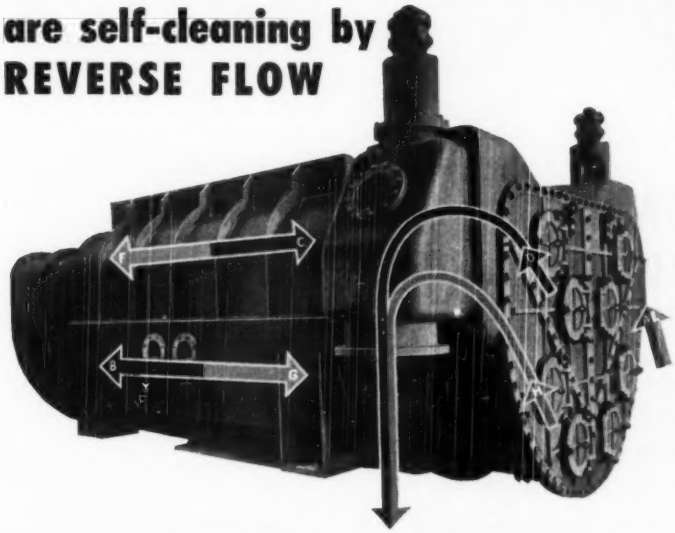
Rettaliata, dean of engineering at

NOTES for the Power Engineer

C. H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS—STEAM JET EJECTORS—COOLING TOWERS—VACUUM REFRIGERATION—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE REDUCTION MILLS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY

C. H. Wheeler CONDENSERS are self-cleaning by REVERSE FLOW



End Downtime for Cleaning Maintain Constant Full Load

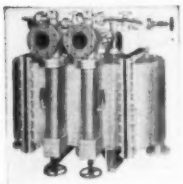
Now you can end your troubles with clogged tube sheets. No longer need you shut down a steam condenser while a conglomerate of refuse—vegetable, animal and mineral—is laboriously removed by slow hand methods.

C. H. Wheeler has developed a simplified method for *reversing* the flow of cooling water in either single or divided water box condenser designs. Rapid reversal of cooling water flow effects a sudden change in temperature which shocks and dislodges marine growth. The physical force of the water flushes this and all other debris, including sand and muck, down the discharge.

The self-cleaning reverse flow is accomplished in new C. H. Wheeler condensers by built-in valves or sluice gates. A push button performs the flow-reversing operation. What formerly took hours is now accomplished in a matter of minutes with no interruption in load.

If you don't need a *new*, integrally built, Self-Cleaning Condenser, C. H. Wheeler can apply the Reverse-Flow principle to other steam condenser installations by means of external piping and four-way valves. Your correspondence is invited. C. H. Wheeler is "Ahead in Condenser Development."

STEEL SHELL TUBEJET AIR EJECTORS MORE RELIABLE . . . SAVE SPACE



Engineers' fears of porous castings have led many to specify separate inter-after condensers with air ejectors. These fears are now totally dispelled with the new C.H. Wheeler Steel Shell Tubejet Air Ejectors. Designed originally to attain compactness for marine installations, thousands of these ejectors rendered outstanding service in World War II. This streamlined version of the older design effects considerable savings in space and weight. They are being widely adopted for stationary power plant use. Available with either single or multiple element, two-stage type with combined surface inter-after condenser. The coupon will bring you Specification 88, just released. It shows preferred method of piping to control hotwell level in main condenser.

THIS NEW CATALOG WILL BRING YOUR CONDENSER INFORMATION UP-TO-DATE

C. H. Wheeler Mfg. Co.,
1800 Sedgley Ave., Philadelphia 32, Pa.

Name .....

Department .....

Company .....

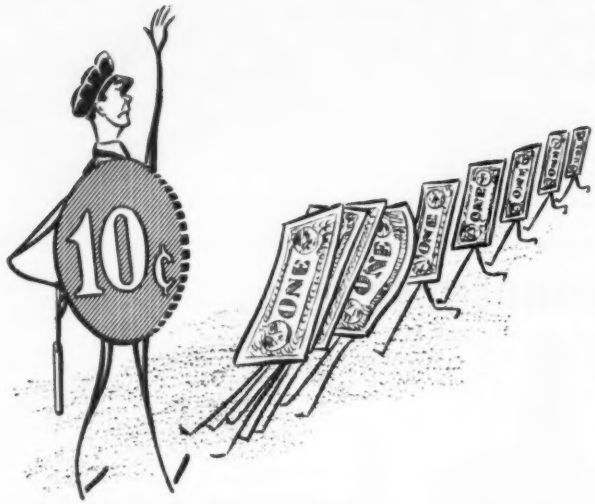
Address .....

Please mail me file material on C. H. Wheeler

☐ Self-Cleaning Condensers ☐ Tubejets (Specification 88)

C. H. WHEELER MANUFACTURING CO. 1800 SEDGLEY AVE., PHILADELPHIA 32, PA.

REPRESENTATIVES IN MOST PRINCIPAL CITIES



"A DIME SPENT NOW *on proper design*
CAN STOP THE MARCH
of wasted coal dollars".

EQUIPMENT LASTS FOR YEARS
COAL FOR SECONDS

Fairmont Coal Bureau Engineers have the facts and figures on hundreds of plants that have been designed to efficiently burn Fairmont Low Fusion Coal.

Their "know-how" applied to your problem might result in lower steam costs for you.

Write today and have your name placed on our mailing list.

FAIRMONT COAL BUREAU
PANHANDLE REGION
WEST VIRGINIA
SERVICE TO INDUSTRY

MAIL COUPON TODAY!

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

Kindly place me on your mailing list to receive copies of your publications and Technical Reference Bulletins. P-12-50

Name _____ Company _____

Position _____ Nature of Business _____

Address _____ City _____ Zone _____ State _____

the Illinois Institute of Technology, and authority on the gas turbine, has been prominent in the Oil and Gas Power Div and the recently formed Gas Turbine Div.

Eckhardt, a University of Texas graduate, and now professor of mechanical engineering and superintendent of utilities at the university, became a member in 1929 during his student years.

Directors at Large. Lionel J Cucullu, New Orleans, La., and Harold E Martin, New York, have been added to the list of directors at large. Cucullu, a Louisiana State University graduate, is now assistant to the chief engineer for the central engineering dept of New Orleans Public Service, Inc. Martin, New York district manager for Babcock & Wilcox Co, is a graduate of Columbia University and the Brooklyn Polytechnic Institute.

COMING EVENTS

Jan 15-18 — Plant Maintenance Show, Municipal Auditorium, Cleveland, O. Held in conjunction with Plant Maintenance Conference, L C Morrow, chairman, Factory Management & Maintenance, New York 18, N. Y.

Jan 22-26—International Heating and Ventilating Exposition, Commercial Museum, Philadelphia, Pa. 57th annual meeting. Charles F Roth, mgr. International Exposition Co, 480 Lexington Ave, New York, N. Y.

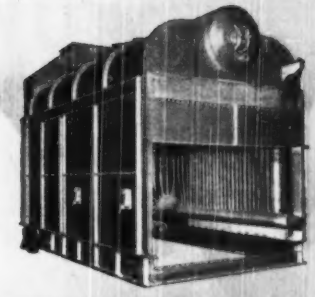
Jan 22-26—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York, N. Y. E C Day, Secy, AIEE, 33 W 39th St, New York 18, N. Y.

March 13-16 — National Assn of Corrosion Engineers, Conference and exhibition, Hotel Statler, New York, N. Y. L B Donovan chairman Consolidated Edison Co, 4 Irving Place, New York, N. Y.

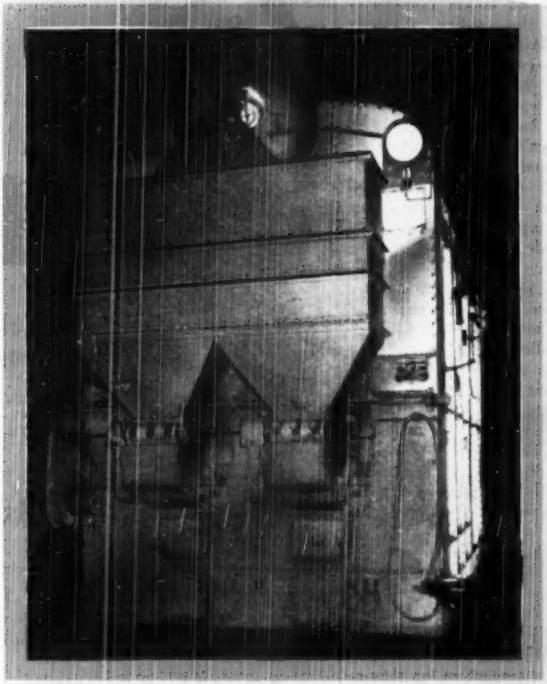
Tobey Receives Nicholls Award

At the 13th annual joint meeting of the American Institute of Mining & Metallurgical Engineers and American Society of Mechanical Engineers, Julian E Tobey, president, Appalachian Coals, Inc, was awarded the highly coveted Percy Nicholls Award. This award is given annually for notable scientific or industrial achievement in the field of solid fuels.

Tobey has long been recognized as an outstanding fuel and power engineer. He is the ninth in a list of prominent engineers to receive this annual award, established in 1942 in honor of the late Percy Nicholls of the U.S. Bureau of Mines. E G Bailey, vice-president, Babcock & Wilcox Co, the first man to receive the award, made the presentation.



UNION
AT
SKINNER ENGINE COMPANY
Since 1921



"A product is known by the company it keeps!" Back in 1868 LeGrand Skinner invented a steam engine, the sire of the Universal Unaflow being manufactured by his namesake and grandson today in Erie, Pennsylvania. More than 90% of all engines of this type in use today as prime movers for the generation of electric power all over the world and on the Seven Seas, are made by the Skinner Engine Company. For 29 years Skinner have used Union Boilers with eminent satisfaction. Installing 2 Union Boilers in 1921, they replaced one in 1949 with a Union 27,000 pounds of steam per hour unit. You can be sure that the 60 years' experience of Union engineers will profit you in the selection of steam generating units as it has so many industries the nation over. Consult with us on your steam power requirements.

The latest Skinner choice is the Stoker Fired Union "S" Type Boiler illustrated above.

UNION IRON WORKS . . . *Since 1890*

373 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL

(*Continued from page* 196)

fail prematurely. It is better engineering to select the drive with some extra horsepower to meet unaccounted for peak or shock loads than to overload the belts by underbelting. The added original cost of an extra groove in the sheaves and a belt will be saved many times in longer belt life and reduced maintenance costs.

V-Flat Drive. It is sometimes permissible where conditions are favorable when converting from flat belts to a V-belt drive to use the driven flat pulley, or flywheel in place of a grooved driven sheave. To obtain satisfactory performance, the pulley diameter should be at least three times that of the sheave. Also, use a flat pulley without a crown, but a pulley slightly crowned may operate satisfactorily.

If the drive has an even number of belts the crown's high point will be between an equal division of the belts. When an odd number of belts are used, the center belt of the drive may try to ride the top of the crown, wobble from side to side, and in doing so wear the belt's cover.

Have the flat pulleys face 10% wider than that of the sheave to compensate for slight side movement of the V-belts on the flat pulley. When designing a V-flat drive be sure to use the right correction factor in table II. A V-belt drive can transmit its rated power on a 180-deg arc of contact. On a 180-deg arc of contact the V-flat drive is good for only 74% of the belt's rating. This is because the belts contact on the flat pulley can transmit only 74% of the power that the grooved sheave can. As the arc of contact on the sheave decreases it increases on the pulley to increase the power that the drive can transmit. Power that the belts can transmit on the pulley and on the sheave is about equal when the belts make a 130-deg contact on the sheave. At this point, as shown in table II, the belts are good for 86% of the power they are when running on two V-grooved sheaves of equal size. At 130-deg arc of contact on the sheave and below, the sheave determines the drive capacity so it is the same for either a 2-sheave V-belt or V-flat drive. This difference in arc-of-contact correction factors for these two classes of drives is something to keep in mind; otherwise, a serious mistake can be made in selecting the drives.

V-belt drives are simple in assembly and operation, but failing to apply sound engineering principles to their selection may cause short belt life and unnecessary expense. The most economical drive is one engineered to meet all existing conditions. Information with which to do this is available from V-belt manufacturers for the asking.

Discarding condensate because of OIL?

If you are throwing away valuable condensate rather than risk its return to the boiler because of oil contamination, filtration with Sorbo-Cel may be the answer to your problem.

Low in Cost

This specially processed diatomaceous silica powder provides a simple, economical method of removing emulsified oil from water and thereby obtaining an oil-free condensate for boiler feed or other use. Total cost ranges from only 1¢ to 3¢ per 1000 gallons of water filtered.

How it works

A small amount of Sorbo-Cel is simply mixed with the oil-contaminated water, which is then pumped through a pressure filter. Here the oil globules are removed by the specially treated Sorbo-Cel particles, and both are retained upon the filter screen. The filtered water alone passes through.

Does complete job

Sorbo-Cel does a complete job of oil removal. In addition, it removes other suspended matter such as rust, scale, clay and precipitates. And its action is so efficient that large volumes of water can be filtered in a relatively short time.

A bulletin that gives further facts about this low-cost way to remove oil from water is available on request. Just use the coupon below.

JM

Johns-Manville
SORBO-CEL

Johns-Manville
Box 290, New York 16, N. Y.
Send me free bulletin giving advantages of Sorbo-Cel filtration.

Name_____

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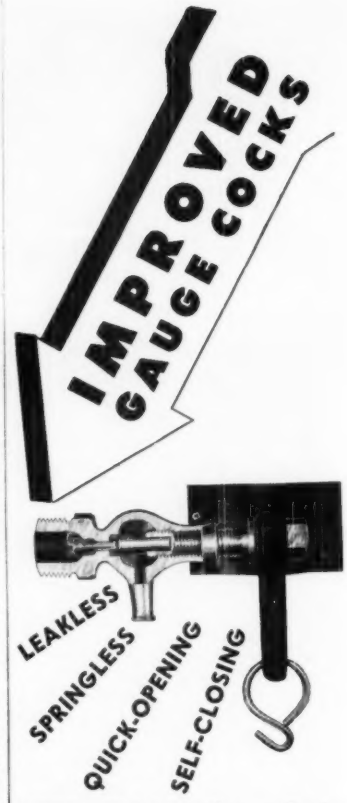
Pow-12



"PBH" Weighted Gauge Cocks

Improved — to give you a weighted Gauge Cock that is leakless — springless — quick opening and self closing! Huyette Gauge Cocks are designed to give you these features—these advantages.

A gentle pull is all that's needed to open this sturdy, long-wearing gauge cock—and an adjustable weight automatically closes it when you let go. It's as easy to operate as that!

Leak-tight service is provided by the use of removable monel metal seat and copper valve pencils.

WRITE TODAY FOR CATALOG AND PRICES.

Other Huyette Products: Water Gauges—Vertical and Inclined . . . Gauge-Glass Protectors . . . Airtite Boiler Wall Coating . . . Water Columns . . . Boiler Alarms, Instruments and Controls.

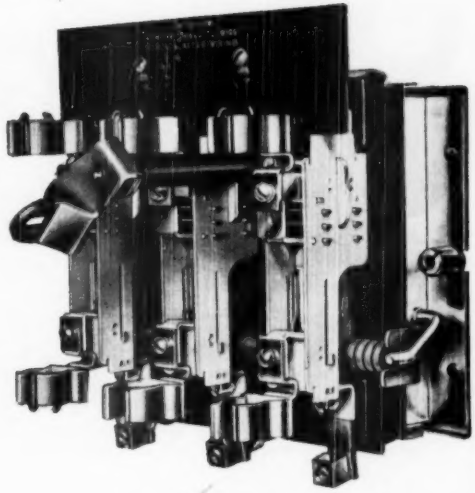
The PAUL B. HUYETTE CO., INC.
Established 1896
401 N. BROAD STREET PHILADELPHIA 8, PA.

NOW...an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

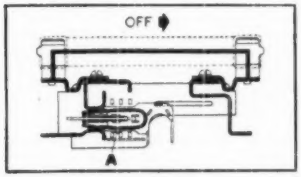
TRUMBULL'S HCI

HIGH CAPACITY INTERRUPTER

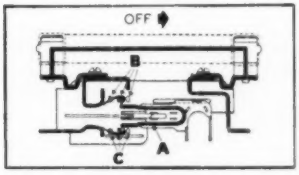
Unusually high interrupting capacity..."circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.



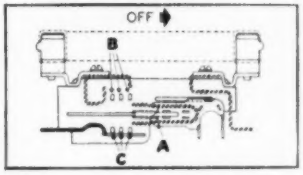
Here's How...
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Heavy line is current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

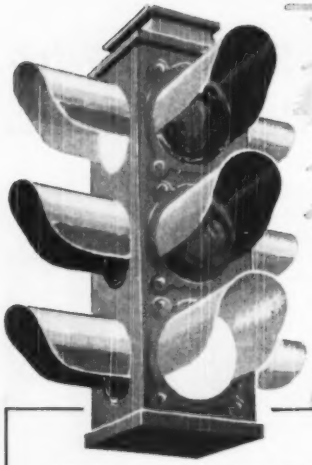
Underwriters' approval throughout.

For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



DRAFT FANS

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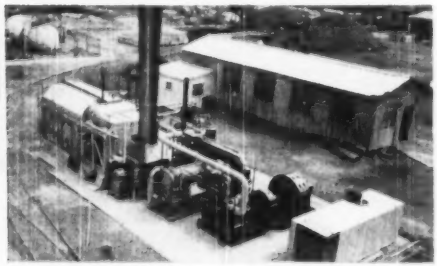
Packaged Boilers Deserve Good Fans, Too!

The same engineering talents and the same careful construction go into the many stack supporting draft fans we have designed for the so-called "packaged" boilers. In some ways, engineering faces more difficult design problems because of the utmost efficiency required in a relatively small space.

Green Stack Supporting Draft Fans are practical, too. They are readily accessible for inspection and maintenance. Shafts and wheels are removable endwise without disturbing the stack or other structural members.

To those manufacturing "packaged boilers" or to those operating them with fans that don't seem to be doing the proper kind of a job or where maintenance seems too high, we offer the services of our experienced fan engineers to (1) design fans suitable for the boiler or (2) study the problem and recommend the remedy.



Our New Bulletin 168 gives details of our Stack Supporting Draft Fans. Write for a copy.

THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

APPOINTMENTS

W F Crawford, president of **Edward Valves Inc.,** East Chicago, Ind., announces the following appointments: John E Stevens Jr becomes assistant to the president. Before joining Edward, Stevens was vice-president of Bergen Genspring Corp. Previously, he had been assistant manager of engineering of M W Kellogg Co and in sales engineering with Eagle-Picher Co and Sarco Co. Carl W Nedderman, for 15 years affiliated with metal-working industries in an executive capacity, is now assistant vice-president. Thomas E Skilling becomes Pittsburgh district sales engineer succeeding the Herr-Harris Co as Edward representative in that area. Skilling, who has been associated with Herr-Harris for several months, will continue his office at 545 William Penn Place, Pittsburgh.

Five engineers have been assigned to new branch office posts of **Bailey Meter Co** as follows: P K Bolyard, 184 Pryor St, SW, Atlanta, Ga.; George J Dunegan, 424 Sharon Bldg, San Francisco, Calif.; L F Monahan, 1506 Kearney St, Denver 7, Colo.; R E Paulson, 7725 Ward Pkwy, Kansas City 5, Mo.; O M Thompson, 2509 Carew Tower Bldg, Cincinnati, Ohio.

General Electric Co reports the following personnel promotions: George Carlson becomes manager of New Kensington, Pa., works in addition to his present duties as manager of manufacturing for conduit products div. Edgar A Reiss is named manager of manufacturing for wire and cable div. C R Benson is appointed manager of sales of GE's Oakland, Calif., transformer plant. B R Zimber succeeds A V Feigenbaum as supervisor of training for the Apparatus Dept. Feigenbaum is now on the staff of C W LaPierre, manager of aircraft gas turbine divisions. In addition, R D Van Norstrand, designing engineer in the Schenectady industrial heating engineering div, is retiring after 37 years of service with the company.

J R Roe and J F Dawson have been named engineers in charge of induction heating sales and induction heating design, respectively, of **Allis-Chalmers** electronics section.

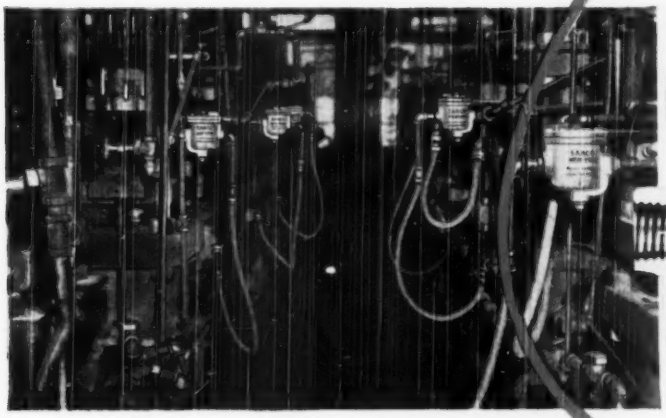
Cyclotherm Corp. Oswego, N. Y., announces appointments of Jack Hallanan as the new vice-president and E J Zisek as general sales manager. Also, R P Leonard becomes assistant general sales manager to aid Zisek in the direction of national sales and distribution of the firm's steam generators.

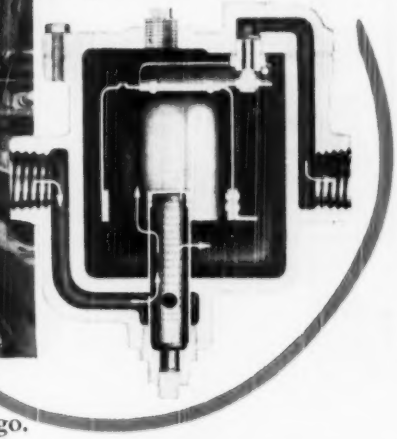
Rear Admiral Paul I. Mather, USN (retired), has become associated with **De Laval Separator Co,** New York City, as manager of its precision equipment div, and special assistant to the president. Mather was formerly administrator of the War Assets Administration and acting member of the Federal Maritime Board.

Heyl & Patterson Inc, Pittsburgh, Pa., announces appointment of H G Dillon as vice-president in charge of sales and B A Rose as vice-president in charge of engineering. E W Kahle is advanced to posi-

five million

TRAP DAYS *of Satisfactory Operation with*

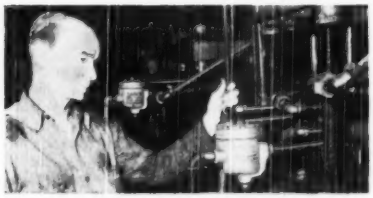




A few of the 100 Sarco Bucket Traps in this Plastics Plant

Here's a "test" to end all tests as far as steam traps go. More than 100 Sarco Bucket Traps in operation 24 hours a day most of the time for more than 15 years! As the manager of this plastics plant puts it "They are tops in satisfaction—what more can I say." And the mechanic who put them in and has had charge of the steam service for 22 years, says "Sarco ended our trapping problems 15 years ago."

IT COSTS LESS TO BE RIGHT— The invariable result of adding Sarco Steam Traps and Temperature Controls to improve production is a *saving in fuel costs*. Heat where you want it, when you want it — never too much — or too little or too late. To be right the first time see Sarco first.



SARCO BUCKET STEAM TRAPS

SARCO Bucket Steam Trap clears condensate instantly. And it costs less to install because of the built-in strainer (at no extra cost) and the straight-thru connection which saves piping materials, time and labor. Ask for Catalog No. 350.

310

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

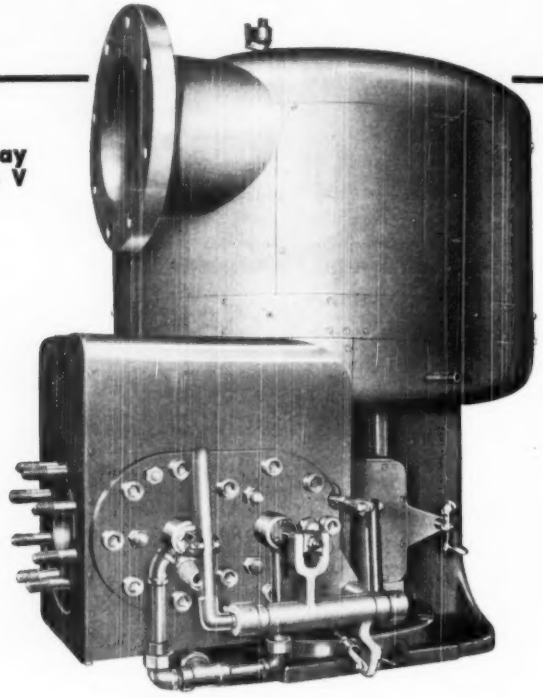
WHY NOT TURBINE DRIVE?

Pumps, fans, compressors, special processing machines, in fact almost any machine requiring driving power can be fitted with an economical and dependable steam turbine driver selected from the many types available.

Steam turbines provide safety, low maintenance expense and ability to operate for long periods without inspection. Unsheltered installations are highly practical.

A large selection of types and frame sizes, special features and accessories are available on short delivery to suit your application.

Murray Type V



Among the newest in the Murray turbine line is the Type V vertical turbine, above. This machine provides completely enclosed construction, either direct-connected or geared for vertical pumps up to 600 HP and beyond. See that your new vertical pump is driven with a Type V steam turbine.

Contact your nearest Murray representative or write direct to—

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century.

tion of treasurer. E E Bauer is promoted to contract engineer for the firm and will serve the steel and utility market in the western territory.

Joseph H Whitney joins the laboratory and research staff of the Power Chemicals Div, **E F Drew & Co.** He will work directly with the research dept in the division's Boonton, N. J., plant. James Quigley, James Devine and Charles T Monroe become laboratory technicians.

Chicago locations of **Hewitt-Robins Inc** have been consolidated at 402 W Randolph St. Offices and warehouses of the Hewitt Rubber, Robins Conveyors and Robins Engineers divisions will be located at the new address. Hewitt Restfoam will continue to maintain its office in the Furniture Mart.

Kinney Mfg Co, Boston, reports that Kenneth Fox has joined the firm as sales application engineer. He will assist customers in the solution of problems involving the use of vacuums.

An independent field sales organization has been set up by **Minneapolis-Honeywell Regulator Co** for its Valve Div. The men assigned to the new organization, the territories they will cover and regional manager of each, are as follows: Eastern region — R Schlegel, manager, New York; branch salesman: F F Pimentel, William Demorest, Charles Hunter, J Douglas, D Douglas, R Love, and Roy Brown. Mid-Atlantic — T L Smith, manager, Philadelphia; branch salesmen: R Lempke and H Frederick. Central — George W Brown, manager, Cleveland; branch salesmen: H Fox, H Hoffman, D Yerks, and T MacDonald. Mid-West — R R Scott, manager, Chicago; branch salesmen: R Easter and J Barolak. Southwest — C F Woods, manager, Houston; branch salesmen: F Benthal and H Odom. Southeast — L Crowe who will work out of Atlanta. Mountain, North Coast and Pacific — W A Clements, manager, Los Angeles. Northwest region will be managed by R R Scott.

John C Ruf, for 10 years Philadelphia district sales manager for **Ohio Injector Co,** retired as of Oct. 1. Paul E Warner has succeeded him in the Philadelphia post.

New plant managers for two **Owen-Illinois Glass Co** plants have been announced. Carl H Smith, presently manager at the Muncie, Ind., plant of the firm's subsidiary, American Structural Products Co, will retire Dec 31. His place will be taken by John E Bauer, now manager of the Berlin, N. J., plant of the company's Kaylo Div. George Walker will move from the Kaylo plant at Sayreville, N. J., to become plant manager at Berlin.

Austin C Ross, manager of the Buffalo works of **Worthington Pump & Machy Corp,** has been elected a vice-president of that company. Harold K Beck, manager of the Washington office, has been elected commercial vice-president. Both men will continue with their present duties. In addition, Murray Equip Co, 11820 Brush St, Detroit, has signed a distributorship

No Other Water Conditioning System Has All of These Features...

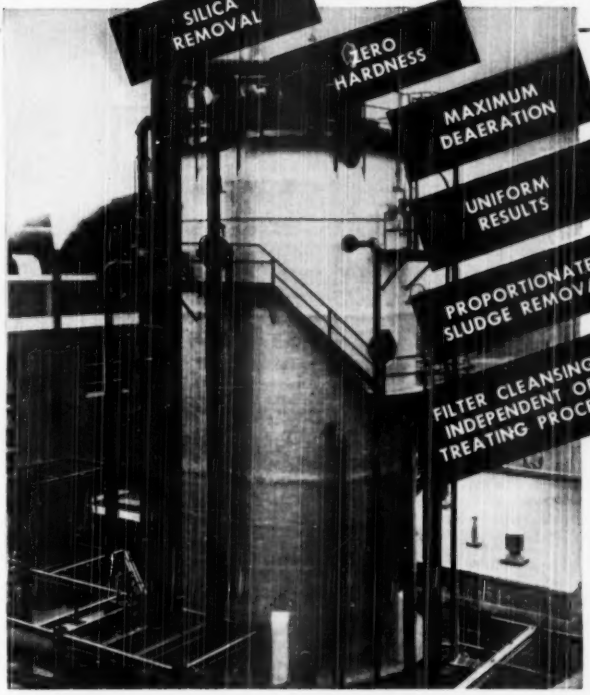
...ALL IN ONE TANK:

YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

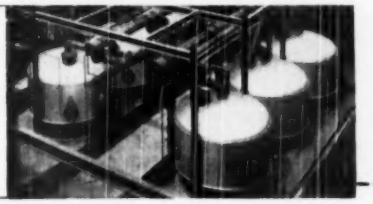
In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

WRITE FOR FACTS

For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*

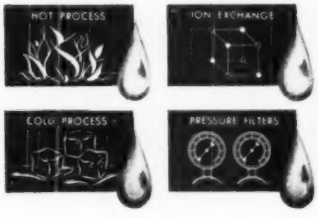


Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour



Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System

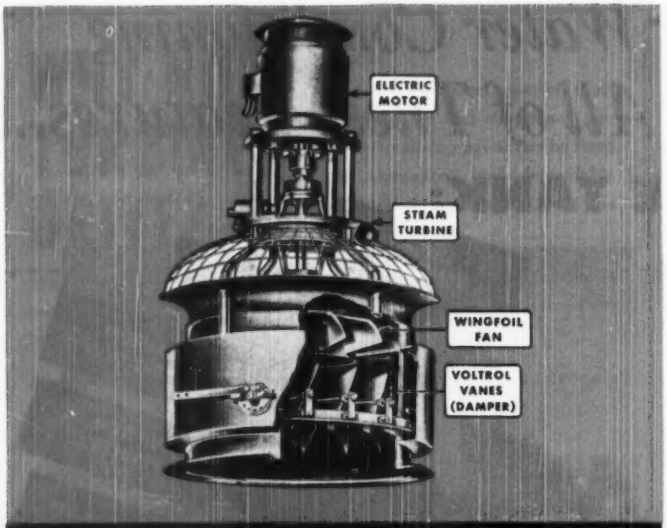
JB-3



WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment For All Types of Water Conditioning Systems



New Wing Forced Draft Blower Incorporates both turbine and electric drive in one unit

With the new Wing Dual Drive Forced Draft Blower you can alternate between turbine and electric drive. Your choice of drive may be governed by consideration of heat balance, of economical operating cost, or by an emergency affecting the source of power. All you have to do is throw a switch to operate the motor or turn a couple of valves to change to turbine drive! There is no harm to either motor or turbine when one or the other is idle. A wide range of control is possible in both motor or turbine drive. Throttling gives adequate control with turbine drive and the Wing Voltrol Vanes (capacity regulating dampers) permit capacity regulation when constant speed motor is driving. Automatic operation may be arranged with combustion-control system. The unit is extremely compact and may be adapted to either vertical or horizontal discharge. Installation is simple, easy and economical. It is shipped completely assembled and aligned, ready to bolt to the foundation.

Write today for further details

L. J. Wing Mfg. Co.

Executive Offices and Factory: 50 Vreeland Mills Road, Linden, N. J.

Canadian Factory: Montreal, Canada

Wing

DUAL-DRIVE BLOWERS

agreement to handle Worthington Multi-V drives and fractional horsepower belts and sheaves in the Detroit area.

Westinghouse Electric Corp, Pittsburgh, names L R Ludwig assistant to the vice-president. In addition, William H Morse is made manager of ac mechanical engineering section in the transportation and generator div at East Pittsburgh. J M Wallace is now manager of switchgear distribution apparatus dept and is replaced by H H Fahnoe as engineering manager of the dept.

Air Reduction Co promotes Leigh W Haefle to assistant chief engineer of its general engineering dept, and Dr E R Blanchard to assistant manager of the research division.

R H McPeake is now sales manager of **Aldrich Pump Co,** Allentown, Pa.

John Hellstrom, vice-president of **American Air Filter Co,** Louisville, Ky., is now in San Francisco as manager of newly created Pacific div, with offices in the Standard Oil Bldg, 225 Bush St. Under his direct supervision will be the business activities of both American Air Filter and its Herman Nelson Div.

Barry Corp has chosen Campion Sales Co, Republic National Life Bldg, Dallas, Texas, as its representative in the Southwestern territory.

Clayton L McDougall is assigned by **Cooper-Bessemer Corp** as sales and engineering representative at its Odessa, Texas, office.

Dow Corning Corp names Earle J Smith manager of the firm's newly-opened branch office at 711 Fourteenth St, NW, in Washington, D. C.

E F Houghton & Co announces a change in location of its sales office from 68-70 Hudson St, Hoboken, N. J., to 55 W 42nd St, New York, N. Y.

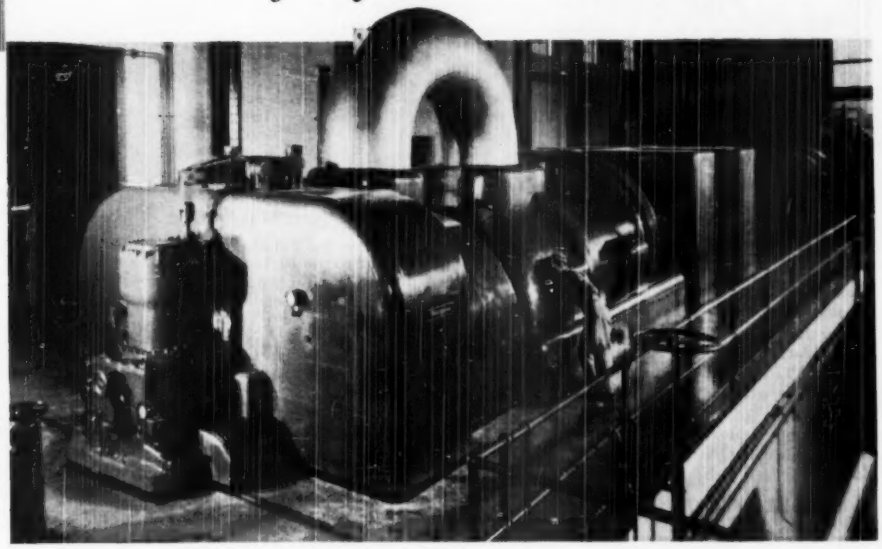
Price M Davis Jr, 5807 N. Crestwood Blvd, Milwaukee, has been appointed factory representative for Michigan, eastern North Dakota, including Bismarck, and eastern South Dakota, including Pierre, by **Hose Accessories Co.** Davis will also continue to cover Minnesota, Wisconsin, northern Illinois and northern Indiana.

A H Engstrom becomes acting engineering manager for American hammered piston rings manufactured by Metal Products Div of **Koppers Co,** Baltimore, Md.

Falk Corp promotes George P Maurer to assistant chief engineer, gear technology; W Stephen Richardson to assistant chief engineer, applications and special products; and Edward J Wellauer to assistant chief engineer, materials and research.

Perfex Corp adds the following field representatives to the sales staff of its temperature controls div: Hugh C Cameron, 2101 Park Ave, Indianapolis, becomes district manager for state of In-

2 ways to insure a clean lubricating system for your new turbine . . .



FLUSH with Gulf Turbine Flushing Oil

FILL with Gulfcrest, the world's finest turbine oil

By taking these two steps, you can insure top lubricating efficiency down through the years for your new steam turbine.

The use of Gulf Turbine Flushing Oil—before the initial fill of lubricating oil—will remove grease-type slushing compounds and carry away harmful abrasives which might be in the circulating system. And, it protects all oil-bathed surfaces against rust. Because Gulf Turbine Flushing Oil is itself a satisfactory lubricant, the undrained portion does not impair the lubricating value of the turbine oil.

Then, to keep the new system clean, fill with Gulfcrest Oil. Because of its outstanding resistance to oxidation, Gulfcrest maintains an exceptionally low neutralization number, and lasts indefinitely. With this quality oil and good operating practice, you can be sure there will be no sludge deposits in cooler tubes, bearing pedestals, or oil lines to worry about.

To get these benefits for your new turbines, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

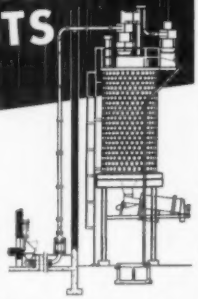
GULF BUILDING, PITTSBURGH, PA.

Sales Offices - Warehouses

Located in principal cities and towns throughout Gulf's marketing territory

GULF INDUSTRIAL LUBRICATION

ADD TO YOUR
PROFITS
BY REDUCING
ASH
REMOVAL
COSTS



Are ash removal costs cutting into your profits? Installation of a NATIONAL Ash Conveyor System will result in substantial savings. The cost is low. Flexible pipeline design simplifies installation in new or going plants. One-man operation cuts labor costs to the bone.

PROVEN PERFORMANCE

National Ash Conveyor Systems now operating in hunderds of important plants (many representing over 25 years of service) give daily testimony to the high quality, low maintenance and superior performance you can expect from a National installation.

NATIONAL — "a good company to work with"

National does not consider a completed installation its final responsibility . . . expert servicing for National Systems is always available. A free yearly check-up and quick delivery of replacement parts, from fully adequate stocks, is part of this dependable service. A twenty-five year record for promptness and dependability has made strong friends of our many clients.

• *Send TODAY for our informative catalog which illustrates typical applications.*

NATIONAL CONVEYORS COMPANY, INC.
50 CHURCH ST., NEW YORK 7, N.Y.
Manufacturers of The National ChipVeyor System For Metal Turnings – Furnace Doors – Feeders – Ash Gates and Related Equipment.

diana; Hugh H Hackett Jr, 127 E 61st St, New York City, will serve as district manager for states of Pennsylvania, Maryland, and Virginia. William P McDowell is assigned the task of appointing and training new Perfex distributors throughout the country, with headquarters in Columbus, Ohio.

R A Snyder and J Cameron Siddall will headquarter in the new sales office of **Pennsylvania Salt Mfg Co** at 2168 Shattuck Ave, Berkeley, Calif.

Enterprise Engine & Machy Co names James Barthmaier district manager of diesel engine sales and service for its New England territory, with headquarters in Boston. Simultaneously, Hugh H Goodwin becomes sales engineer for its New York branch.

A Tonkonogy, 45 Clinton St, Newark, N. J., will handle sales and service for **Industrial Filter & Pump Mfg Co** products in greater New York, Long Island, northern New Jersey, and southern New York State territory.

R C Swenson Jr has joined **Purolator Products Inc** as regional manager with headquarters at the firm's offices in Chicago.

General Controls adds R D Hollingsworth to its staff to work out of the Cleveland branch office. Hollingsworth will specialize on the firm's complete line of refrigeration controls and will cover the Cleveland, Buffalo and Cincinnati territory. J B Miller will headquarter in Washington, D. C., calling on various governmental agencies.

William A Blume has been made administrative vice-president of **Asbestos Mfg Co**, Huntington, Ind. He will continue his residence in Detroit for the present.

S&C Electric Co has chosen W J Brockhouse and R E Martin as sales engineers for the West Central States (Nebraska, Kansas, Oklahoma, and the western counties of Iowa and Missouri). Headquarters will be 300 Porter Bldg, Kansas City, Mo.

P A Durkee acquires position as electrical engineer in the liquid level control div of **Automatic Control Co**, St. Paul, Minn.

Paraffine Companies, Inc, San Francisco, Calif., has changed its name to **Pabco Products Inc**. According to company officials, the firm has made this change because there is no similarity or direct connection between the names "Pabco" and "Paraffine". The trade-name and trademark "Pabco" has been used for approximately 50 years to identify the diversified products of the company. Thus, the new name will identify both the company and products.

Election of ES Haymond, treasurer, **West Penn Power Co**, as assistant secretary is announced. Haymond retains his treasurer's post in addition to the new duties.

American Welding Society announces election of officers for the coming year as follows: *President* — Harry W Pierce,

NOW CLEAN
GENERATORS
MOTORS
Without Solvents

NO Drying Period
Toxic Hazards
with New Pangborn AC-4
Blast Machine

NOW YOU CAN clean electric motors, generators and turbines *without solvents!* The new Pangborn AC-4 Blast Machine scours armatures, parts, frames, coils, etc. with soft (20-mesh) corncob grits.

Since no liquids are used there is no need for drying periods and toxic or explosive hazards are eliminated. Large equipment can be cleaned *in place* and no residue is left to create gum or to break down insulation.

Simple and Inexpensive

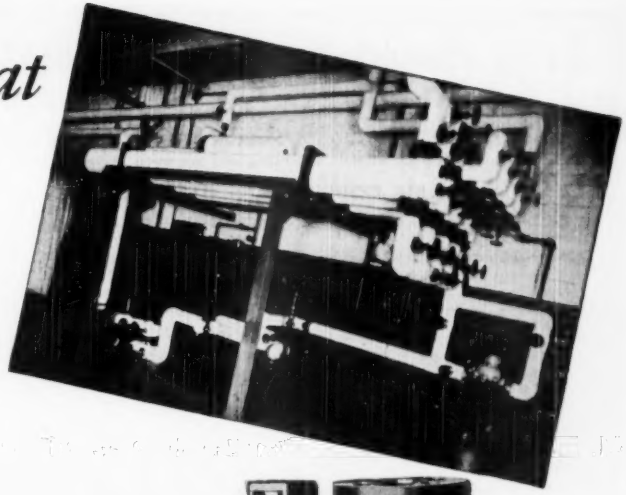
New Pangborn AC-4 Blast Machines operate from a standard 40-pound air supply. Material costs average 1/10 of other methods and complete cleaning is finished in half the time.

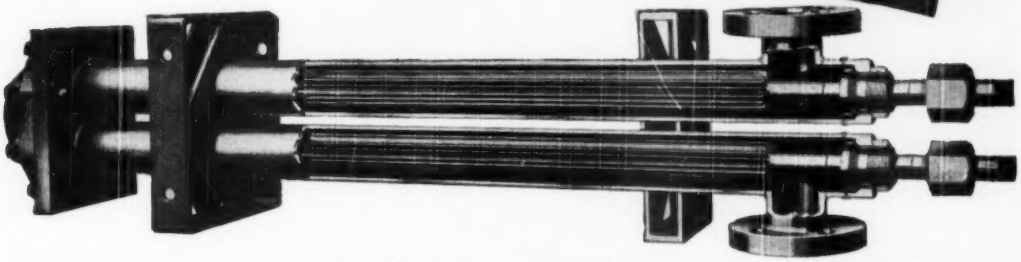
FOR DETAILS, write today outlining your operation. Address: PANGBORN CORPORATION, 90 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

Pangborn
BLAST CLEANS CHEAPER
with the right equipment
for every job

Isn't this what you want in a **FUEL OIL HEATER?**





SIMPLE — Just a pipe within a pipe—that's the principle of the Twin G-Fin Section. The G-Fin inner pipe, through which the steam passes, has longitudinal fins to provide greater surface for transfer of heat to the oil flowing through the outer pipe.

COMPACT — The longitudinal G-Fins provide at least six times as much heat transfer surface as bare tubes . . . the result: the Twin G-Fin unit has fewer tubes than any other type of heater.

LEAK PROOF — Leakage between steam and oil cannot occur because there are no internal joints.

READILY INSTALLED — The Twin G-Fin Section is easily handled, and can be placed close against a wall, ceiling or floor . . . wherever most convenient. Movable supports further assist convenient installation.

FLEXIBLE CAPACITY — These units are standard and interchangeable. They may be arranged in series or parallel; and at partial loads, sections may be cut in and out to maintain constant oil temperature.

EASY TO CLEAN — The G-Fin heating elements or pipes may be completely removed from the shells for cleaning, without disturbing the oil connections. No special tools are required.

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y. GR-192

GRISCOM-RUSSELL
TWIN G-FIN SECTION
The Universal Heat Exchanger

On to Philadelphia...for NEW IDEAS!

Latest developments in HEATING, VENTILATING, and AIR CONDITIONING facilities . . . latest trends and practices in adapting them to all types of industrial plants and offices . . . a wealth of practical, cost-saving ideas—all are in store for plant officials, engineers, and operating personnel at the—

10th AIR CONDITIONING EXPOSITION

International Heating & Ventilating Exposition

Over 300 informative, technically-staffed exhibits and demonstrations will afford you unequalled opportunity to see and compare at one time hundreds of new and improved items from complete units to maintenance supplies—to discuss your plans, problems and requirements first-hand with engineering specialists.

Plan ahead *now* to attend this foremost event of its kind . . . to get more valuable information, more progressive ideas, more worthwhile contacts than you can acquire in any comparable time or way. Note the date—January 22-26, 1951.

Auspices of the American Society of Heating and Ventilating

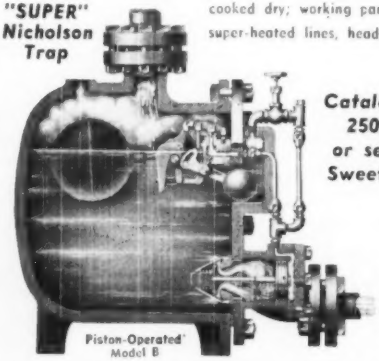
Engineers Management International Exposition Company

Most Widely Used Way of Trapping

HEAVY SLUGS of CONDENSATE

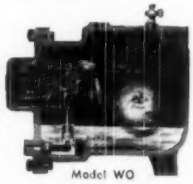
Thousands of installations on steam purifiers attest to the enormous drainage capacity of this Nicholson trap. Piston-operated and with valve orifices up to 2" diameter, it discharges large volumes of water almost instantly. Wont leak even if cooked dry; working parts of stainless steel. Also for super-heated lines, headers, separators, etc.

"SUPER" Nicholson Trap



Piston-Operated Model B

Catalog 250 or see Sweet's



Model WO

NICHOLSON WEIGHT-OPERATED TRAPS — Three models for pressures to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.

W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.

assistant to president, New York Shipbuilding Corp, Camden, N. J.; *first vice-president* — Charles H Jennings, engineering manager, welding dept, Westinghouse Electric Corp; *second vice-president* — Fred L Plummer, director of engineering, Hammond Iron Wks, Warren, Pa.

L. B McNight vice-president, Chain Belt Co, Milwaukee, succeeds John M Alvey as president of **Conveyor Equipment Mfrs Assn.** Other officers elected are: *vice-president*—G W Ostrand, general manager, Caldwell Plant, Link Belt Co, Chicago; *treasurer* — Earl D Stearns, general manager, conveyor div, Barber-Greene Co, Aurora, Ill.; *secretary* — Lee Sekulski, sales manager, Mathews Conveyor Co, Ellwood City, Pa.

Howard Cooper, manager of technical service of Sinclair Refining Co., New York, has been elected president of **National Lubricating Grease Institute** for the ensuing year.

OBITUARIES

Dr Robert Doherty, 65, who retired from the Carnegie Institute of Technology presidency in July of this year, died Oct 19 in Scotia, N. Y.

Maxwell W Day, 85, retired head of the onetime marine engineering dept of General Electric Co, died Sept 26 at the Waverly Sanitorium in Montgomery County, N. Y.

Earle S Henningsen, 60, retiring manager of engineering of General Electric's large motor and generator divisions at Schenectady, N. Y., died Sept 23 at Easton Memorial Hospital, Easton, Md., after a brief illness.

Michael D McMann, 81, for 25 years engineer of the Harvard Knitting Mills, Wakefield, Mass., died Sept 26.

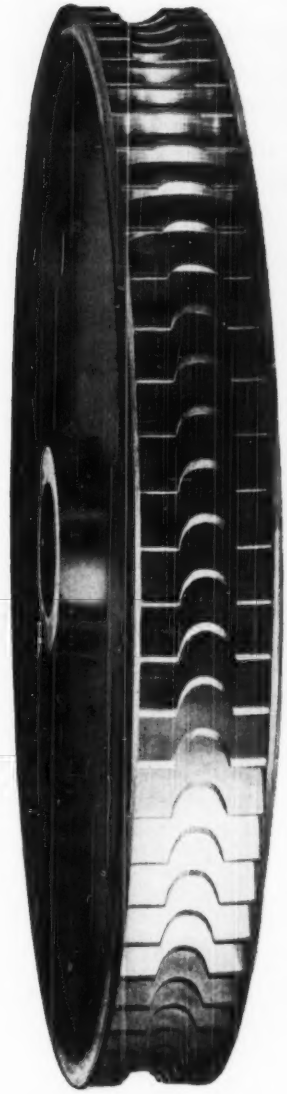
Burt C Taylor, 54, vice-president and treasurer of Dayton Power & Light Co, died suddenly Oct 13 at his home in Dayton, Ohio.

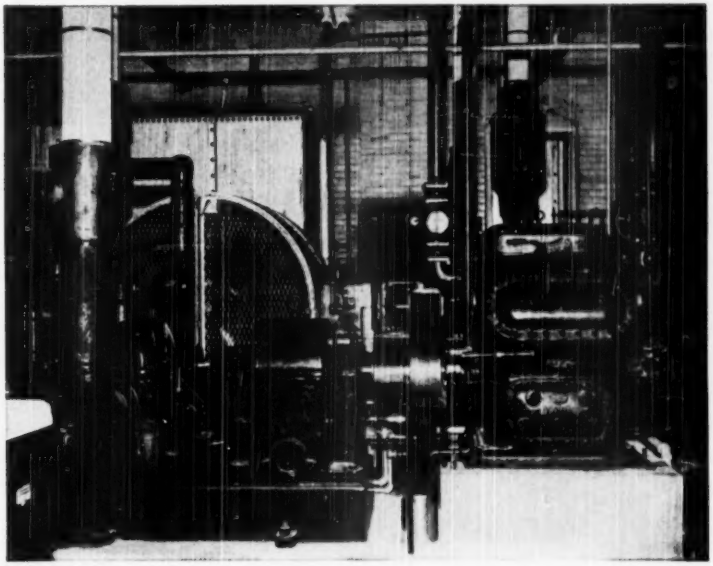
Arelin L Wagoner, 65, who retired as purchasing agent of steel and steel products for General Electric Co on April 1, died Sept 28 in Ellis Hospital, Schenectady, N. Y.

Babcock & Wilcox Co have prepared a pictorial display panel outlining development of steam-generation equipment, for distribution to interested engineering colleges, technical schools, public-utility plants, industrial training courses. The panel, 38 in. high by 54 in. long, consists of a series of pictures with text showing the high spots in boiler development since energy was first harnessed through the medium of steam.

Bureau of Mines has released a report No. 4720 entitled, *Burning Anthracite Barley on a Chain-Grate Stoker in a Two-Arch Furnace*, by L R Burdick and R E Morgan, bureau engineers. It describes how to use small sizes of anthracite. Publication, available on request, may be had from the Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

the Terry Turbine





Refrigeration Compressor Driven By Terry Turbine

AT HAMPDEN BREWERY

This 150 hp Terry Turbine — at the Willimansett, Mass. plant of the Hampden Brewing Co. — operates at 3800 rpm with a gear reducing it to 720 rpm. It is coupled to a 6 cylinder reciprocating compressor.

The installation is running on steam conditions of 120 psi — 0° superheat, and the steam to the turbine is automatically throttled to maintain a constant 30 psi back pressure for process and heating. The installation was developed by Fred Ophuls & Associates Consulting Engineers.

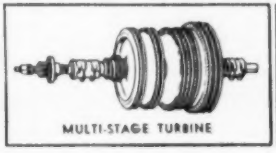
Get more information on the wide range line of Terry Turbines from your local District Representative. There's no obligation for a complete discussion of your specific requirements. Also send for Bulletin S-143 that gives full details.

THE TERRY STEAM TURBINE CO.

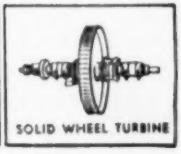
TERRY SQUARE, HARTFORD 1, CONN.

TT-1106

Terry



MULTI-STAGE TURBINE



SOLID WHEEL TURBINE

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AUTOMATIC CONTROLS FOR INDUSTRIAL APPLICATIONS REQUIRING POSITIVE CONTROL OF PRESSURE, TEMPERATURE, LIQUID LEVEL ETC.

SIMPLE TO ADJUST FOR THE SPECIFIED OPERATING RANGE

MERCOID CONTROLS ARE EQUIPPED WITH MERCURY SWITCHES, THEREBY INSURING GREATER SAFETY, BETTER PERFORMANCE AND LONGER CONTROL LIFE

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The easiest way to prepare to pass

engineer license examinations

with this complete guide on power plant operation and maintenance

HERE is the fully revised and up-to-date Second Edition of a well-known practical book that offers much information to help you pass power plant engineer license examinations. It thoroughly explains advanced rules of stationary engineering—outlines tested methods of operating power plant equipment—and points out the responsibilities of the operating engineer relative to safe practices and efficient operation of power plants. At the end of each chapter you are given valuable lists of questions typical of those asked in license examinations . . . the answers to which are contained in the chapter material.

Just Published!

STEAM PLANT OPERATION

By EVERETT B. WOODRUFF, Maintenance Engr., The Drackett Co., and H. B. LAMMERS, Chairman and Director of Engin., Coal Producers Comm. For Smoke Abatement

Second Edition.
543 pages, 264 illus., $7.00

No matter what your link with the stationary engineering field, you'll find this a practical guide on all phases of power plant equipment construction, operation, and maintenance. Latest advances in steam boilers, pumps, steam engines, steam turbines, and auxiliaries are described in detail. You are shown how to control the combustion of fuels . . . how to inspect boilers and steam engines . . . how valves function . . . and how to solve practical power plant problems without the use of advanced mathematics. Geared to the needs of the power plant engineer, this book is an invaluable aid in better understanding modern steam plant operation—in preparation for engineering license examinations of different grades.

Check these chapter headings

1. Boilers
2. Construction of Boilers
3. Combustion of Fuels
4. Settings, Combustion Equipment, and Heating Surfaces
5. Boiler Accessories
6. Operation and Maintenance of Steam Boilers
7. Pumps
8. Reciprocating Steam Engines
9. Valve-operating Mechanism
10. Operation and Maintenance of Steam Engines
11. Construction of Steam Turbines and Auxiliaries
12. Operating and Maintaining Turbines and Auxiliaries
13. Auxiliary Steam-Plant Equipment

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This offer applies to U.S. only

only a **1 MAN JOB**

Storing Coal with a SAUERMAN SCRAPER

Yes, a Sauerman Power Drag Scraper, whether it is a small machine storing and reclaiming a hundred tons a day or a large installation handling thousands of tons a day —can be operated by one man.

This low labor expense is just one of many reasons why Sauerman equipment is chosen to take care of stockpiling at so many power plants. Other advantages of this equipment are its reasonable first cost, almost negligible maintenance expense and the fact that it builds a pile in well-packed layers so that there are no voids to cause spontaneous combustion.

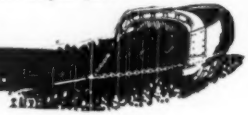
STORY BEHIND THE PICTURE

Above is the Sauerman scraper coal storage layout at the West Central Heating plant, Washington, D. C. A 100 h.p. Sauerman machine, equipped with a trolley and monorail at the tail end, handles a 16,000-ton stockpile on a small triangular area alongside the plant. Being in a residential section of the nation's capital, it was essential to use a handling method that would not create undue noise and dirt, and this was an added reason for choosing the Sauerman scraper. The operator is stationed in a cab overlooking the storage area and all he has to do is manipulate a few switches controlling the scraper hoist and the monorail winch.

Advice and Literature Freely Supplied

Write us about your storage problem. Our catalog and suggestions on equipment will be mailed to you without obligation on your part.

Forty-One Years of Service to Industry



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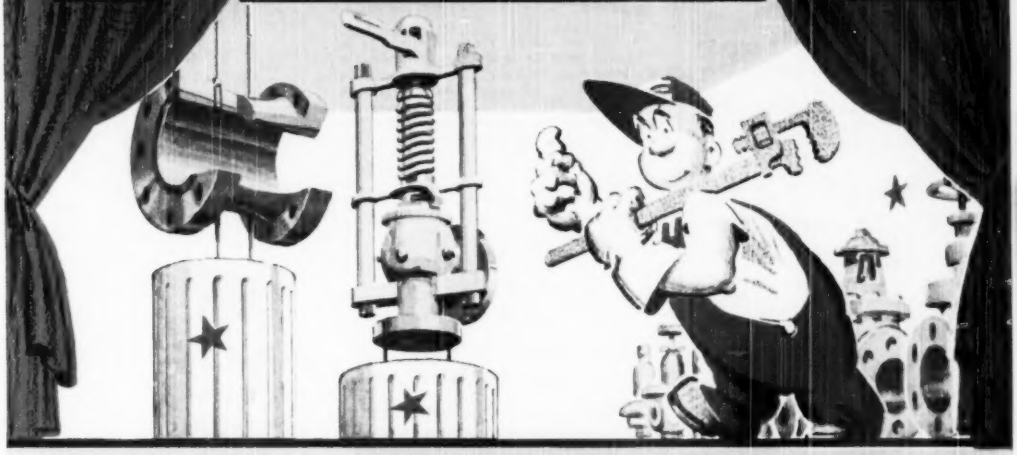
STAR PERFORMERS

at the 19th National

POWER SHOW

Grand Central Palace, N. Y., Nov. 27-Dec. 2—Booths 38-39

FOSTER ENGINEERING Company



★ FOSTER FLOW TUBE

(Gentile Patents)

The revolutionary differential producer for metering flow of liquids and wet or dry gases:

- **Compact** . . . short spool piece
- **Easy to Install** . . . like a fitting
- **Reversible** . . . reads flow in either direction
- **Low Head Loss** . . . low main-to-throat ratio
- **Accurate** . . . equal or superior to conventional primary elements in accuracy

★ FOSTER 38-SV

The revolutionary safety valve that has shattered all performance records. Guaranteed advantages:

- Tight Seating
- Consistently Accurate Popping
- Minimum Blow-Down (can be held to as little as 1%)
- Highest Relief Capacity for a nominal valve size
- Extremely Low Maintenance

★ FOSTER AUTOMATIC VALVES

The complete Foster line has always been noted for HIGH Reliability and low Maintenance.

• • •

Make a note right now to see the Foster line in Booths 38 and 39, it will pay you. And if, for any reason, you can't get to the Power Show do the next best thing—drop us a line, and we'll send you a set of illustrated bulletins, many of which will be available for the first time at the show.

FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . CUSHION CHECK VALVES . . . ALTITUDE VALVES . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . SIRENS SAFETY VALVES FLOW TUBES

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the condition of

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***with* CAT'S EYE**

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*(Have been televised to Boiler Control Panel)

Ask for full details

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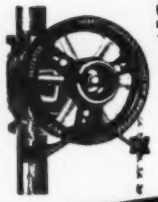

SIMPLIFIES OVERHEAD VALVE CONTROL

Babbitt —*Adjustable*— **SPROCKET RIM** *with Chain Guide*

• Range of 10 adjustable sizes takes care of all valve makes and types: fits valve wheel diameters from 2 to 36 inches.

• Pull the chain! That's all there is to open or close overhead valves—for complete control from the floor! Operating action of the BABBITT Adjustable Sprocket Rim with Chain Guide is as positive and instantaneous as that of direct manual control—and 100% safer because the dangers of climbing treacherous stepladders, or on benches, machines or boilers is completely eliminated.

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

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NOW *Get ready for Winter!*

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Now's the time to prepare for cold weather! Cut your power costs . . . modernization saves up to 10% on your fuel and maintenance bills. Let skilled Todd specialists engineer your boiler plant for maximum economy — either by modernizing obsolete equipment or providing a new and efficient installation.

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Gives each wearing point a full-time 'oiler'.

Manufacturers using Manzel Lubricators report that they save their initial cost many times over in reduced labor cost, lower oil consumption, and fewer breakdowns. "Manzels" are standard equipment on many makes of engines, pumps, compressors, hydraulic presses, conveyors, and other machinery. Or... you can install them on present equipment.

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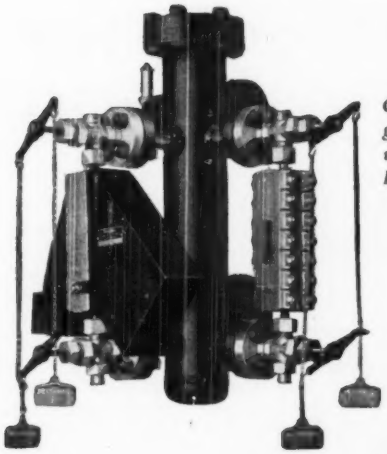
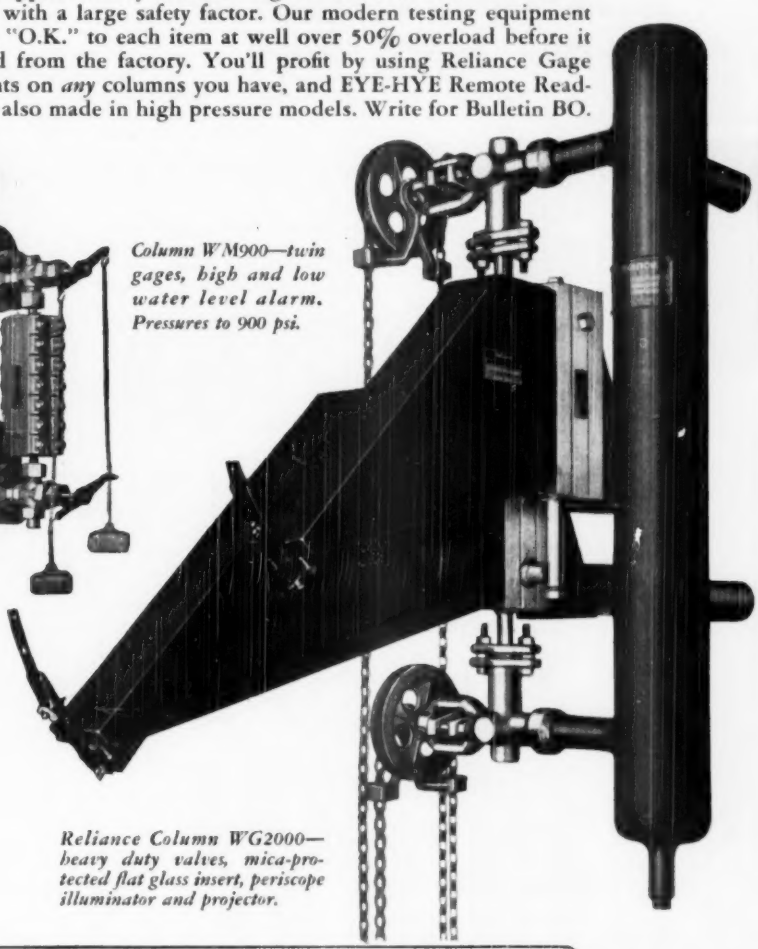
Protect your high pressure plant with Reliance super-rugged columns and water gage equipment.

THE extra margin of safety you like to be sure of in high pressure equipment is generously built into Reliance Water Columns and Gages. For accident-preventing low-maintenance "boiler trim", Reliance supplies sturdy welded forged steel construction rated to 2000 psi, with a large safety factor. Our modern testing equipment has to say "O.K." to each item at well over 50% overload before it is released from the factory. You'll profit by using Reliance Gage components on *any* columns you have, and EYE-HYE Remote Reading Gage, also made in high pressure models. Write for Bulletin BO.



Column WM900—twin gages, high and low water level alarm. Pressures to 900 psi.



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Reliance Column WG2000—heavy duty valves, mica-protected flat glass insert, periscope illuminator and projector.

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GIGANTIC UNDERGROUND STORAGE USES Frick Refrigeration

Originally a limestone quarry, the Natural Cooler Storage of the U. S. Dept. of Agriculture near Atchison, Kansas, is one of the largest refrigerated warehouses in the world, having capacity for 3,000 carloads. A temperature of 32 degrees F. is held in the great cave by two Frick 4-cylinder compressors, driven by motors totaling 600 horsepower.

Frick Compressors with Motors Totaling 600 Horsepower, at Natural Cooler Storage.

For that important cooling job of yours, specify Frick air conditioning, refrigerating, ice-making or quick-freezing equipment.

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When you are looking for the answers to "What's available?" "Who makes it?" "Where can I get it?" —you'll find them quickly and easily in the

1950 Mid-June POWER Buyers' Guide Number

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Announcing

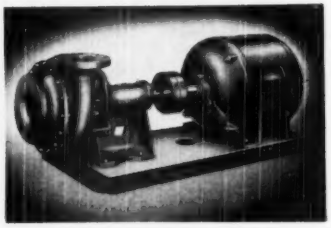

Fig. 3169, single stage, open impeller centrifugal

7 MORE SIZES IN THIS NEW CENTRIFUGAL LINE

This new and extremely successful line of centrifugals is now available in 10 sizes. You can now take advantage of the efficiency of this new design to fill your pumping needs in a wide variety of applications.

APPLICATIONS: Goulds designed the Fig. 3169 especially for general water service, irrigation, Slurries, circulation, transfer and factory wastes. It also gives excellent service in air conditioning, plumbing, heating, processing and related applications.

ADVANTAGES: The most important advantage of these pumps is their efficient, modern design. Simple construction, light weight and compact size give you reasonable price and unusually good service over a long period of time.

CAPACITIES: Fig. 3169 is made in 10 sizes for both motor and belt drives. Capacities to 1000 G.P.M. with heads to 180 ft., depending on capacity.

For more information call or write Pump Headquarters or your nearest Goulds dealer. Ask for Bulletin 720.4.

Goulds PUMPS INC. Seneca Falls New York

If you need steam... you need WICKES

35,000 lbs. steam per hour from each of these two WICKES 2-Drum Steam Generators

Throughout the world, industries that depend on steam have learned by experience to depend on *Wickes* Steam Generators. The *Wickes* Type S 2-Drum Boilers shown here have found wide acceptance in the chemical processing industry because the Type S boiler is *adaptable to any standard method of firing* — oil, gas, single retort underfeed or spreader stoker — and, because of the low head design, this boiler is practical where space is limited. *Wickes* can fill your most exacting requirements for steam generators up to 250,000 lbs. steam per hour and 850 pounds per square inch. If you have a boiler problem, our knowledge of steam generation is *available to you without obligation* . . . write today for descriptive literature on *Wickes'* complete line of steam generation equipment.

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129

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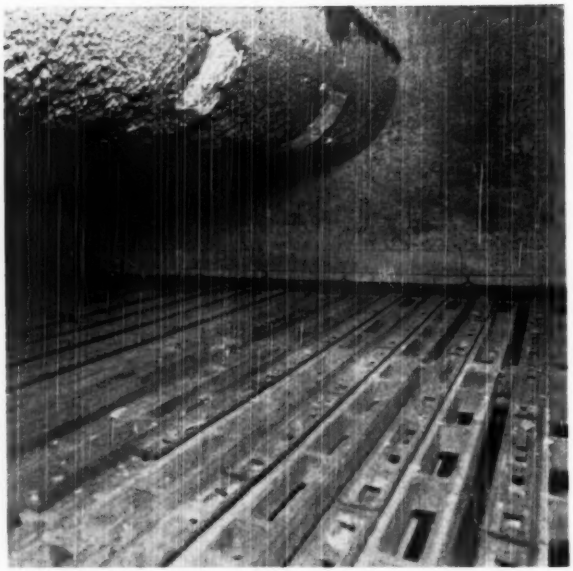
HOW TO AVOID THE 3 COMMON CAUSES OF BOILER WALL FAILURE



LOWER MAINTENANCE COSTS in boiler furnaces result from Norton Crystolon* (silicon carbide) brick at the clinker line, thanks to their high refractoriness, resistance to slag penetration and to abrasion.

If high heat, slag penetration and abrasion at the clinker line are causing you frequent shutdowns and excessive maintenance costs, it's time to investigate Norton Crystolon (silicon carbide) shapes . . . hollow air-cooled blocks or solid bricks.

Proved Properties

1. Norton Crystolon shapes are highly refractory . . . successfully resist temperatures up to 3100°F.

2. Made in very dense form with a maximum percentage of silicon carbide, they effectively resist slag penetration. In rare cases when clinkers do adhere, you can easily remove them without damage to the refractory.

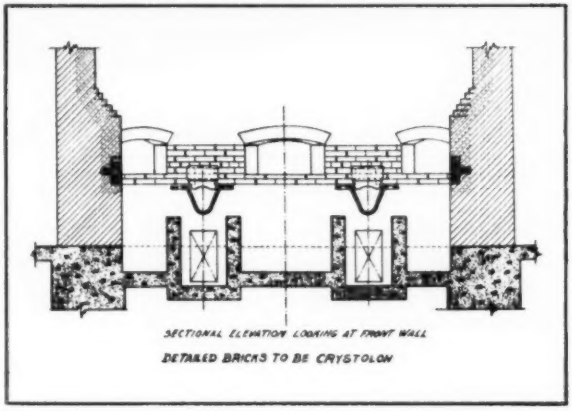
3. Since silicon carbide is a tough abrasive, Norton Crystolon blocks and bricks are not noticeably affected by the abrasion of the moving fire bed of stoker-fired furnaces.

All Shapes

Norton Crystolon air-cooled blocks and solid bricks, with mating tongues and grooves for easy installation, come in any size and shape your furnaces call for. Norton Type A (rectangular), Type B (T-shaped) and Type C (U-shaped) blocks and bricks are also available for replacement purposes.

Get All The Facts

For more complete information about Norton Crystolon silicon carbide shapes, consult your nearby Norton representative, or write direct for Bulletin 862. NORTON COMPANY, 601 New Bond Street, Worcester 6, Mass.



NORTON CRYSTOLON BRICKS, as detailed in this front wall elevation, quickly pay for themselves where spalled, eroded or cracked refractories previously have caused frequent shutdowns.

NORTON

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Making better products to make other products better

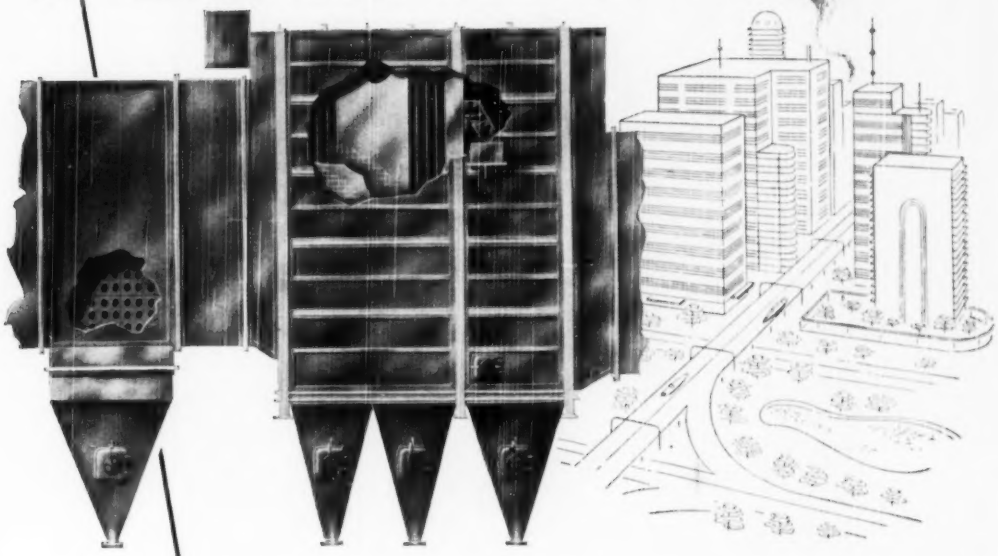
Special REFRACTORIES

Canadian Representative

A. P. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO

engineered for the *Future*

THE AEROTEC SERIES COLLECTOR



Your dust collection equipment, a major investment, merits a thorough survey of the present trend toward more stringent dust ordinances.

To plan for the future, a collector should meet today's collection requirements, with provisions made for increasing the efficiency when dust ordinances become more stringent. It is well known that a mechanical collector is economical to operate. Such a collector therefore, that will meet present dust ordinance requirements and serve later as the primary to an electrical secondary, seems the logical choice.

The Aerotec Series Collector provides just this service. The primary, a highly efficient Aerotec Mechanical composed of multiple small diameter tubes, will meet most stringent dust ordinances in effect today. Should collection requirements be increased, the secondary, an Aerotec "Pocket-Type" Electrical Precipitator, is easily added to provide the finest in dust collection efficiency.

The Thermix Corporation, Project and Sales Engineers for the Aerotec Corporation, welcomes the opportunity to prove the sound engineering behind this arrangement . . . a combination engineered for the future.

AEROTEC

Project and Sales Engineers

THE THERMIX CORPORATION

Greenwich, Connecticut

Canadian Affiliates: T. C. CHOWN, LTD., 1440 Saint Catherine St., W., Montreal 25, Quebec; 50 Abell St., Toronto 3, Ontario

THE AEROTEC CORPORATION

GREENWICH, CONN.

PUT THIS New Low Cost IMO ON YOUR OIL LINES!

I-161R

Now you can have all the advantages of the IMO: high speed operation – quietness – freedom from vibration – simplicity – reliability – at less cost than ever before.

Look at the cross-section and you will see why no other pump is quite so well suited for oil handling service.

The axial flow design permits oil to be pumped close to the rotating axis of the rotors. This means low liquid velocity and quiet operation at high speeds.

Large inlet areas provide smooth entrance of liquid into the pump and permit the handling of high viscosities at high suction lifts.

The A313A IMO has no stuffing boxes to leak or require packing, and best of all, it can be mounted in any position and be directly connected for operation at motor speeds.

For your next oil handling job, be sure of the best . . . specify the new low cost A313A IMO pump. Bulletin on request.

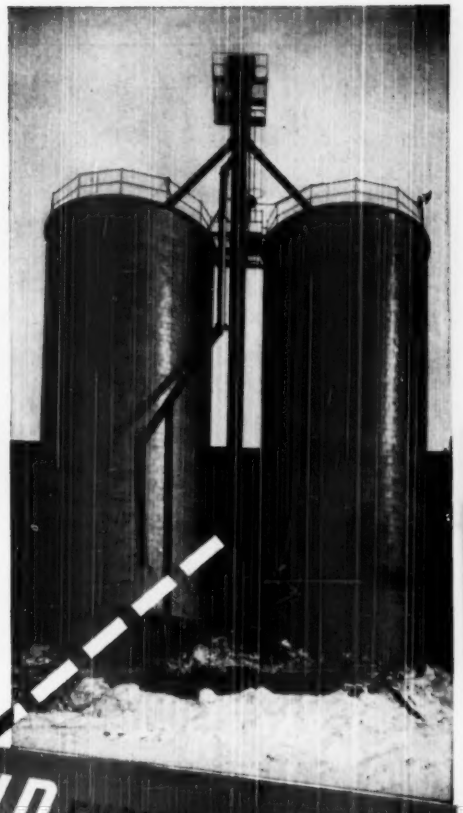
Write for Bulletin I-161R-P.

IMO-DELAVAL PRODUCTS DIVISION

DeLaval Steam Turbine Company, Trenton 2, New Jersey

DE LAVAL

here's how to improve your power plant operation this year . . .



CALL IN YOUR FAIRFIELD ENGINEER TODAY!

and see how you can gain new economies with FAIRFIELD Coal & Ash Handling Systems.

Every month, a big dollar entry goes into your overhead ledger for power plant operation. Any reduction in that overhead figure—more efficient and economical operation—means greater profits to you.

Your FAIRFIELD engineer can survey your present plant and make recommendations that will give you more efficient and economical operations at absolutely no obligation to you. Write or call today for an appointment with the FAIRFIELD engineer in your area.

MAKERS OF

Coal & Ash Handling Equipment • Portable Conveyors and Car Unloaders • Specialized Material Handling and Mixing Equipment.

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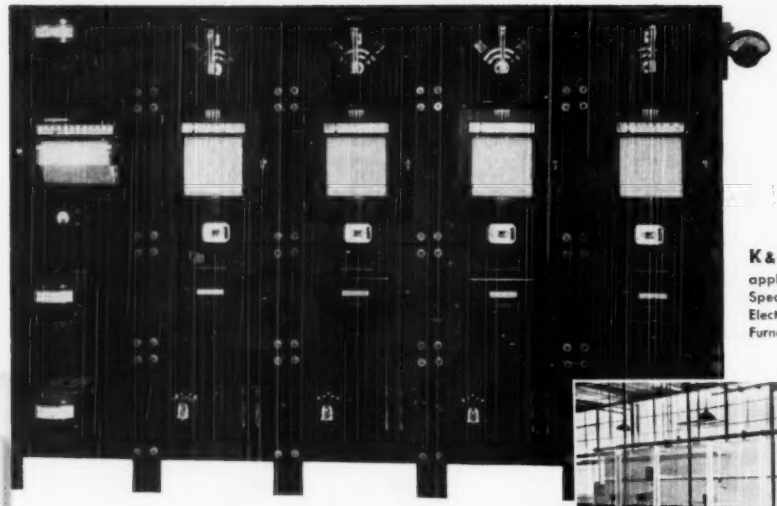
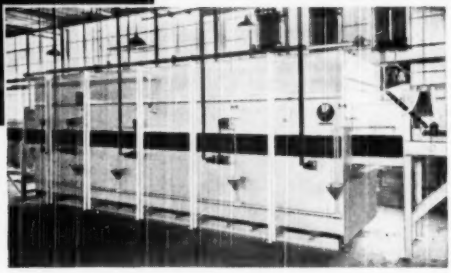


K&M EBONIZED ASBESTOS
applied to control mountings of the Special Atmosphere Roller Hearth Type Electric Furnace, made by The Electric Furnace Company, Salem, Ohio.



K&M EBONIZED ASBESTOS
FOR SAFE MOUNTINGS THAT STAY PUT

The Electric Furnace Company's Special Atmosphere Roller Hearth Type Furnace is modern high-efficiency equipment. Control panels must live up to the same standard. Therefore K&M Ebonized Asbestos was adopted. This advanced K&M electrical mounting material combines unusual dielectric strength, mechanical strength, compactness and shipshape finished appearance. These values endure because K&M Ebonized Asbestos resists shock, vibration and temperature effects.

In addition to lasting serviceability, K&M Ebonized Asbestos means simplified production and assembly. Time savings result from the easy handling and cutting; the quick, clean machining and drilling.

The all-around utility of K&M Ebonized Asbestos is based on the proved K&M composition of asbestos fiber and binding cement—pressure-molded to high density, and impregnated with special insulating compound. Thicknesses from $\frac{1}{8}$" to 4" are available, so that engineers and designers are readily able to make a wide range of applications—switchboard mountings—bus bar runs—compartment linings—test tables, bench boards and the like. Full details regarding any uses will be promptly sent on request. Write us.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

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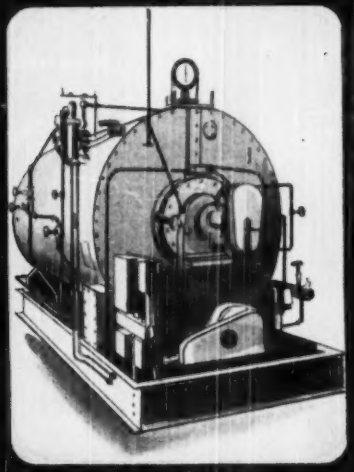

WHY PACKAGED BOILERS NEED DEARBORN WATER TREATMENT SERVICE

HOW DEARBORN MAKES THIS VITAL SERVICE AVAILABLE TO YOU

WHY! There is no essential difference—except size—in the operation and maintenance of packaged boilers and the largest boiler installations. Packaged boilers, whether in large or small plants, are vulnerable to all the consequences that may result from untreated or inadequately treated water. But, it is also true that a properly conceived and administered water treatment program will save time and money by increasing the efficiency of your packaged boilers.

HOW! In the same way—with the Dearborn Industrial Water Treatment and Engineering Service—that the largest boiler installations are kept at highest operating efficiency. Dearborn has for years maintained a program designed particularly for packaged boilers, including (1) laboratory analysis; (2) treatment recommendations and adjustments; (3) continuing test procedures; and (4) proportioning pumps and feeders. This service is available to you.

WRITE! The Dearborn Plan for Packaged Boilers puts all the facilities and years of experience of Dearborn chemists, engineers and technicians at your service. Write for complete information about this plan and how it will produce substantial savings for you. The coupon is for your convenience.

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310 S. Michigan Ave. • Chicago 4, Ill.

Dearborn Chemical Company
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Please send complete information on the Dearborn Plan for Packaged Boilers.

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TRADE MARK REGISTERED
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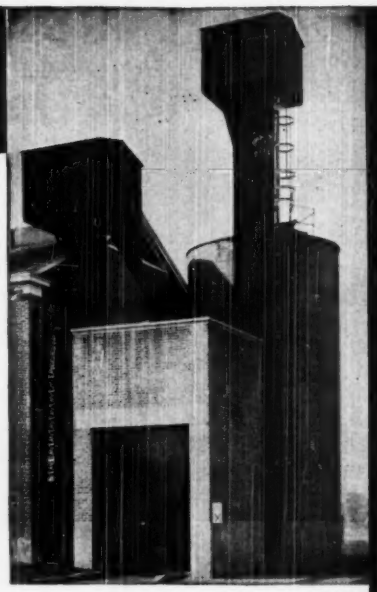
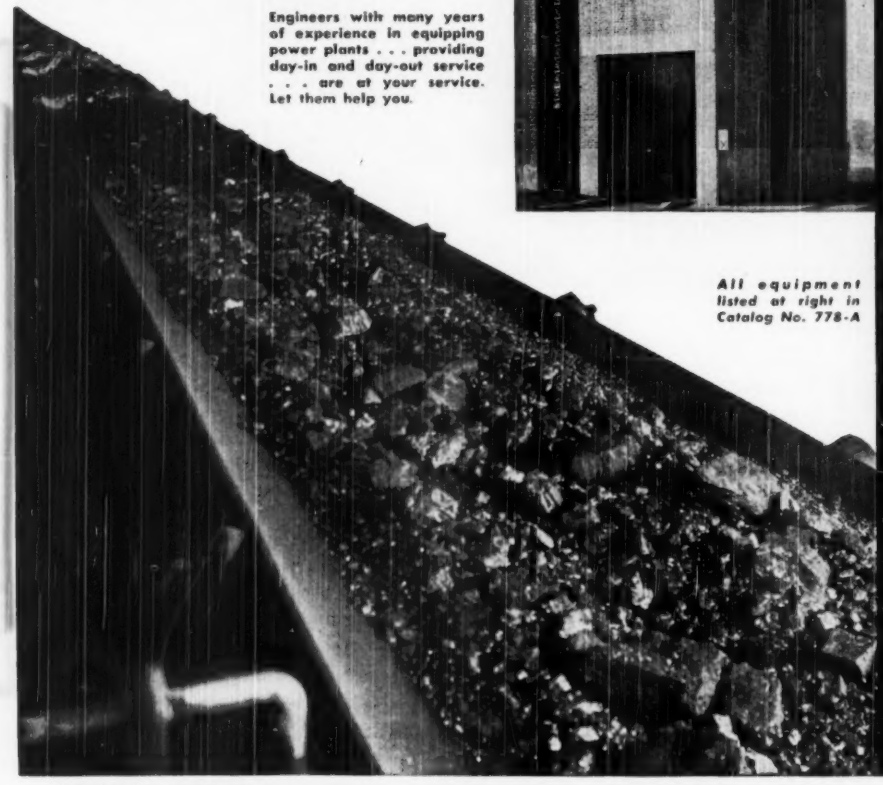
Dependability
— First Consideration

Coal and ashes handling machinery must be right. Failure especially during peak-load periods can be just as disastrous as the failure of the power generating equipment. Besides giving remarkably low cost per ton of coal handled, Jeffrey equipment has been safeguarding many plants for years. There is an efficient system for every type and size of plant.



Engineers with many years of experience in equipping power plants . . . providing day-in and day-out service . . . are at your service. Let them help you.



All equipment listed at right in Catalog No. 778-A

- Apron Feeders
- Ashes Handling Systems
- Bin Valves
- Belt Conveyors
- Belt Idlers
- Bucket Elevators
- Chains
- Car Pullers
- Crushers
- Drag Chain Conveyors
- Drive Arrangements
- Pivoted Bucket Conveyors
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Complete Line of Material Handling, Processing and Mining Equipment

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SPECIFY ANKORITE SUPER HEAT VALVE DISCS

The problems of your Valve Discs are solved by the adoption of **ANKORITE SUPER HEAT VALVE DISCS** for all Globe and Angle Valves operating on steam, air, water, gas, oils ...and many other services where temperatures run to 400 degrees Fhr.

ANKORITE SUPER HEAT VALVE DISCS are molded from a special compound developed through long research and experiment. This compound will resist the action of heat, oil and solvents, and the age-resisting properties are far superior to any compounds heretofore used in the manufacture of valve discs.

ANKORITE SUPER HEAT VALVE DISCS will not swell or crack under service.

ANKORITE SUPER HEAT VALVE DISCS are made in all sizes for valves ¼" to 24" with round or oval hole.

We shall gladly send full details on request.

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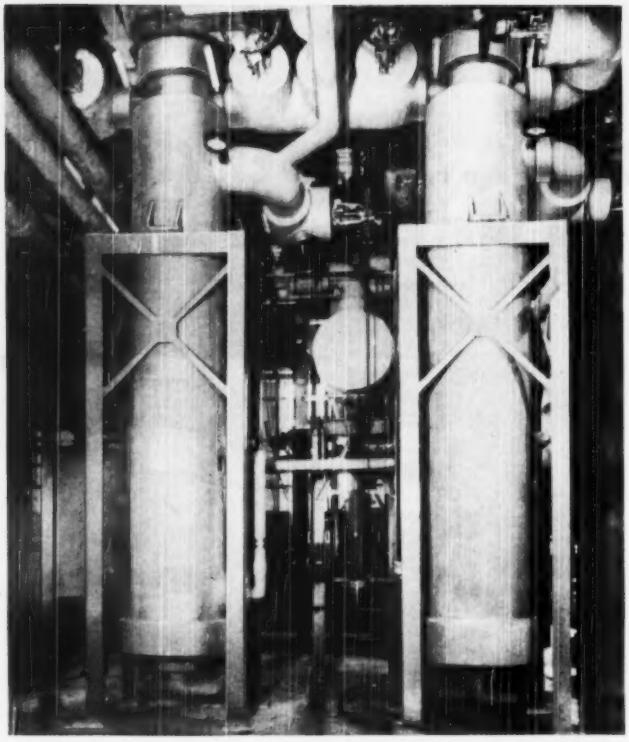


THREE CONSECO FEED WATER HEATERS

SERVING A LARGE SOUTHWESTERN CENTRAL STATION

In the above photograph are shown the following CONSECO Feed Water Heaters:

1—Low pressure horizontal unit of 485 sq. ft. surface having a capacity of 95,000 lbs. of feed water per hour, heating from 111.3° to 180.9° at 125 psig with steam at 8.5 psia. This unit is of the pull through bundle type.

1—Intermediate pressure vertical unit, with a heating surface of 550 sq. ft. handling 123,000 lbs. of feed water per hour, heating from 217° to 293° at 800 psig, with steam at 64.6 psia. Heads are of cast steel. Heater is of vertical pull through type.

1—High pressure vertical unit handling 123,000 lbs. of feed water per hour, heating from 293° to 362° at 800 psig, with steam at 167.2 psia. This heater has cast steel heads and is of the vertical pull through type.

CONSECO engineers are at your service to design heat exchanger equipment to meet your specific requirements. Their long specialized experience and the fabricating facilities of Condenser Service will enable you to obtain the maximum in performance and economy.

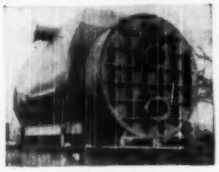
Send for illustrated engineering bulletins on Condensers, Feed Water Heaters, Evaporators, Deaerators, Boilers, Steam Jet Air Ejectors and Refiner Filters.

CONSECO

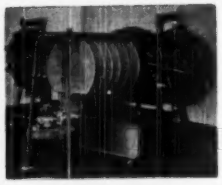
BOILERS

DEAERATORS

EVAPORATORS



CONDENSERS



REFINER FILTERS

STEAM JET AIR EJECTORS

CONSECO

Condenser Service & Engineering Co.

HOBOKEN, N. J.

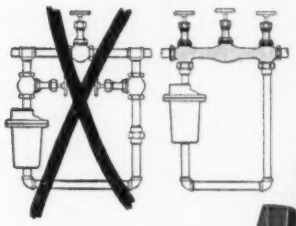
In power or process piping, you'll

SAVE

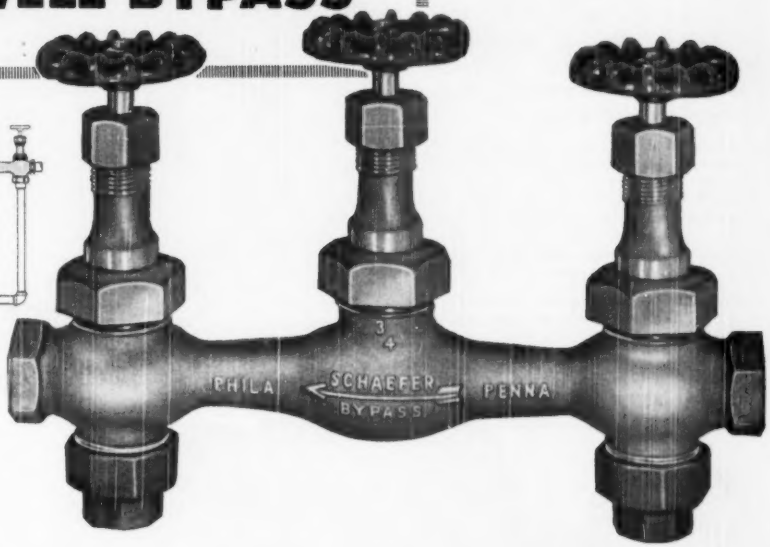
money
space
maintenance
weight
time

WITH THE

HONEYWELL BYPASS



Outmoded set-up at left uses 18 threaded joints . . . Honeywell Bypass uses only eight.



THE Honeywell Bypass is a completely assembled and ready-to-use unit . . . compact and convenient. It eliminates from eight to fourteen threaded joints . . . with the usual leakage and maintenance . . . and affords continuous, trouble-free operation.

Yet it costs no more than the assortment of valves, nipples, fittings, unions and pipes (plus the cutting, threading and assembling) that you may be using now. The Honeywell Bypass is available in Bronze, Iron and Steel . . . for pressures up to 300 lbs. . . . with screwed or flanged ends.

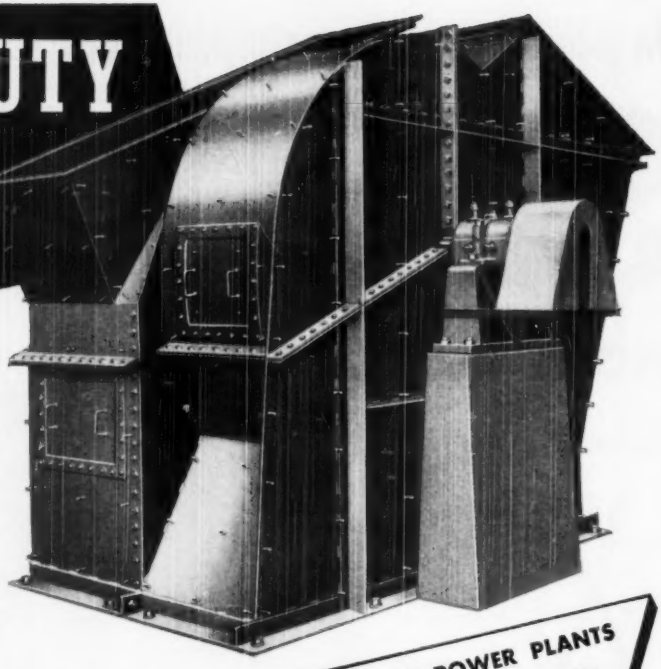
Call in your local Honeywell engineer for detailed information on this bypass and such other Honeywell products as: Hi-Lift Hand Control Valves, Transfer Valves, Narrow Band Diaphragm Control Valves, Liquid Level Devices and Steam-Jacketed Rotary Cocks.

Write, today, for a copy of Bulletin #254-1. MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1900 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS **Honeywell**

VALVE PRODUCTS

HEAVY-DUTY for *Important* FAN JOBS

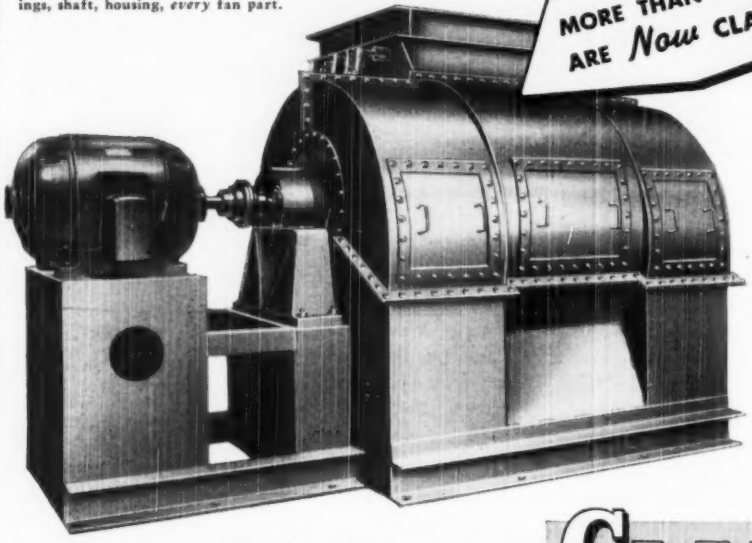


This ad shows Clarage Type RT Fans, especially designed and built for *tough* air handling services — large volumes (up to 300,000 c.f.m.), high static pressures, high temperature applications.

Induced draft is one of the services to which this Clarage equipment is *particularly* adapted. The Type RT Fan at right is arranged for induced draft fan work. It is equipped with inlet box, insulation clips and water-cooled bearings which permit the handling of extremely high temperature gases with long-lasting performance.

Type RT Fan construction is HEAVY-DUTY — and that applies to wheel, bearings, shaft, housing, *every* fan part.

MORE THAN 3000 POWER PLANTS ARE *Now* CLARAGE EQUIPPED



The Type RT Fan at left is equipped with *fan*-cooled bearings. For medium high temperature work (industrial process air handling and some types of induced draft), *fan*-cooled bearings — *a Clarage development* — are practical and *less expensive* than water-cooled bearings.

All Type RT Fans operate at speeds suitable for direct drive from electric motors or steam turbines.

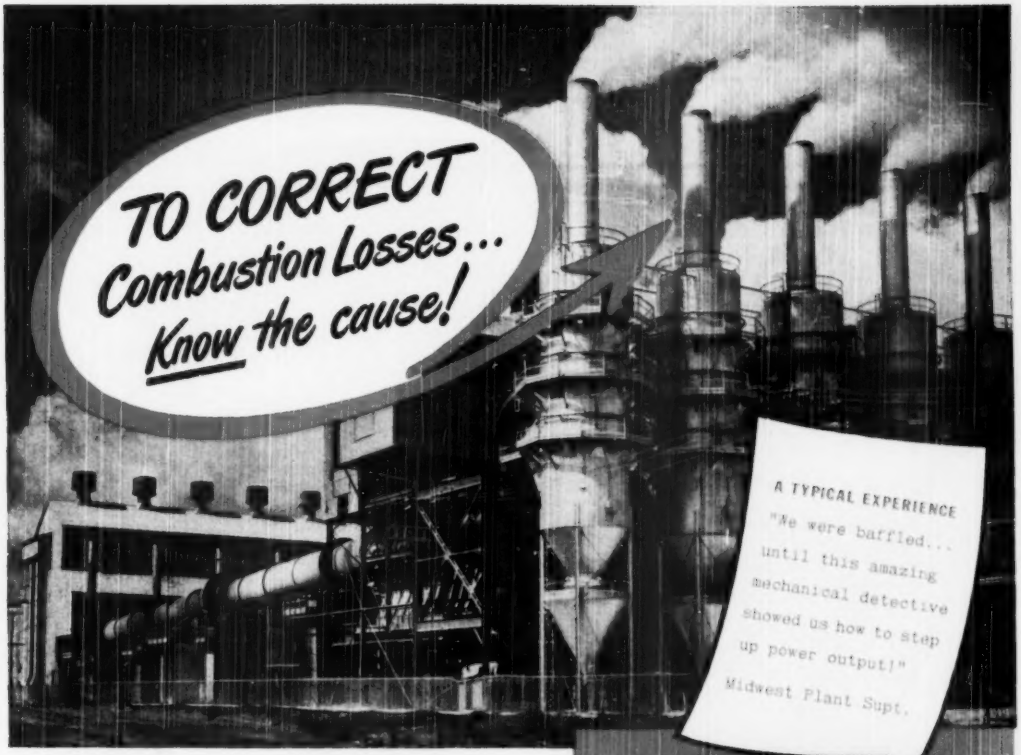
DIRECT YOUR INQUIRY INTO CAPABLE HANDS

Clarage equipment — from the smallest to largest fans — is built HEAVY-DUTY. Whatever your air-handling problems, we can provide satisfactory results at astonishingly low operating and maintenance costs. *Your inquiry is invited.*

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

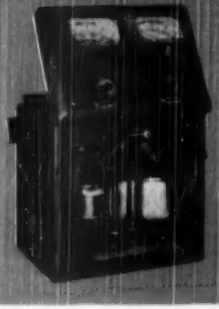
CLARAGE
—HEADQUARTERS for Air Handling and Conditioning Equipment

Sales Engineering Offices in All Principal Cities

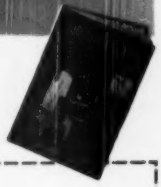

TO CORRECT
Combustion Losses...
Know the cause!
A TYPICAL EXPERIENCE
"We were baffled... until this amazing mechanical detective showed us how to step up power output!"
Midwest Plant Supt.

Rule-of-thumb methods in tracing causes of fuel waste and power loss have been made obsolete by the Cities Service Industrial Heat Prover. A recent case is typical: Heat was plainly being wasted; production was suffering, and routine "corrections" had failed. Then a Cities Service engineer was called in. As always, a Heat Prover test quickly supplied data on major combustion factors. The evidence pointed to outright heat leakage – confirmed by discovery of cracked brickwork. After repairs the average power output jumped 22%!

Similar contributions to production efficiency are reported often—because the reliability of Heat Prover combustion analysis makes it simpler to determine effective corrections. Ask about this service for your plant.



The Industrial Heat Prover is a flue gas analyzer. It tells you quickly and accurately how much efficiency you are getting from furnaces and heat production units.



FREE – Booklet completely describes the Cities Service Heat Prover. Mail coupon for your copy.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CITIES SERVICE OIL COMPANY
Sixty Wall Tower, Room 773
New York 5, New York

Please send me without obligation your new booklet entitled "Combustion Control for Industry."

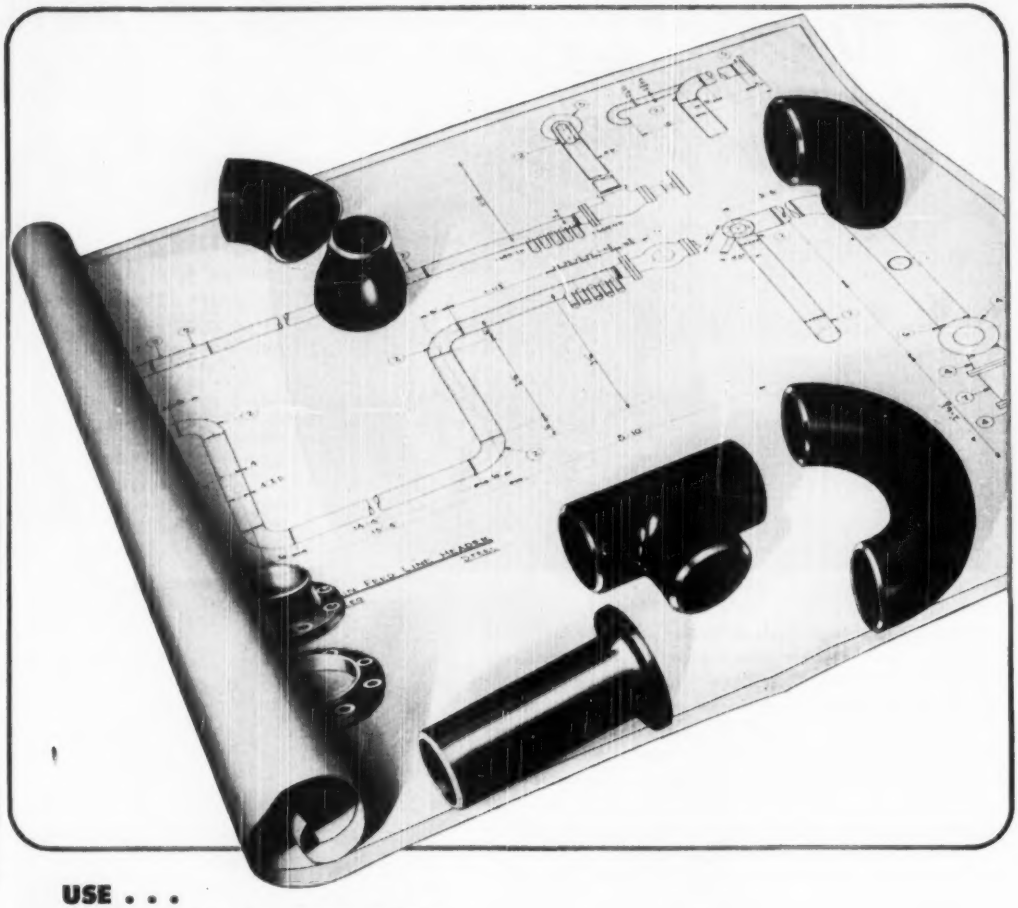
*Name*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

TO DO A BETTER PIPING JOB . . .



USE . . .

GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

When you specify and use Globe Welding Fittings you have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.

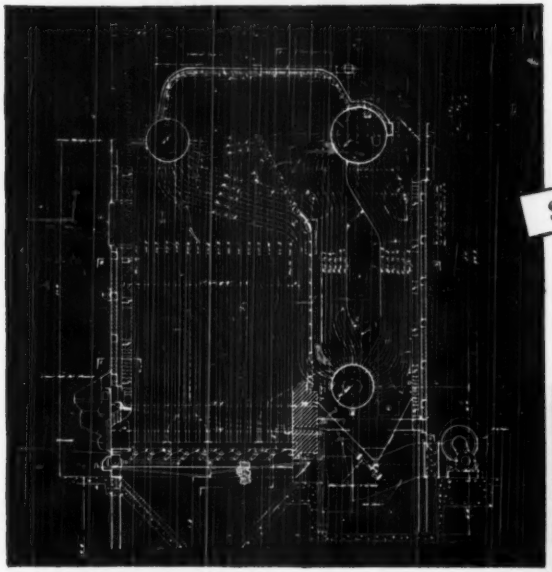
GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin

Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply.

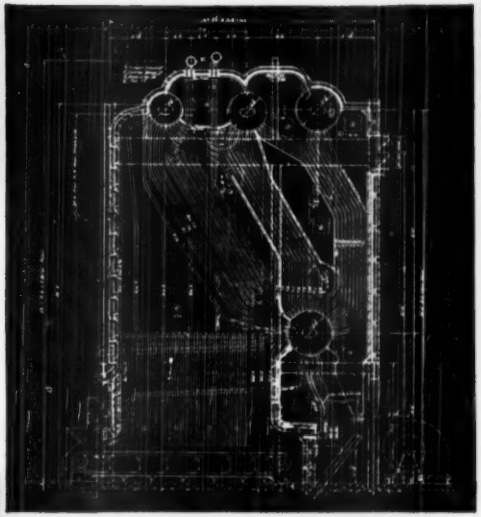
Quick Steaming at all Ratings!



Carry high overloads with high efficiency

SPECIFY Vogt

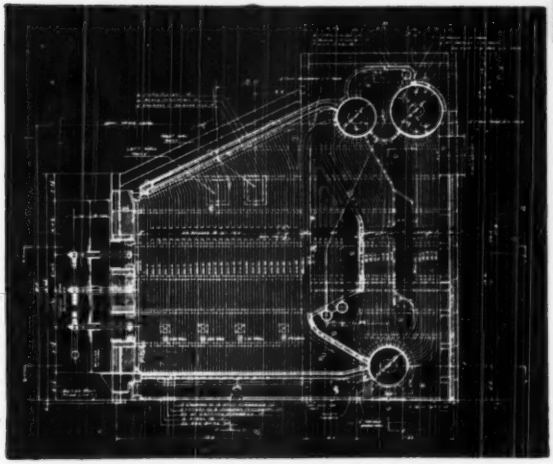
STEAM GENERATING UNITS



CLASS VL — Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE — Mr. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR — 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

distinctively new

Ingersoll-Rand
Multi-Stage Centrifugal Pumps
with unit-type rotor assembly

Here's a high-pressure pump that's *completely modern* in every detail—a compact, streamlined unit that combines all the latest advances in hydraulic engineering.

Ingersoll-Rand Class HMTA pumps feature a simplified, high-strength, horizontally-split casing, and a unique *unit-type rotor assembly*. The multiple volute passages between stages are contained in precision-machined channel rings—assembled on the rotor shaft and locked in position within the smooth, symmetrical bore of the casing. The rotor-assembly elements are all self-aligning—all precision machined to fit together as a unit.

The result—a more efficient, longer-lasting high-pressure pump that offers important savings in operating and maintenance costs. Available in capacities to 1600 gpm and pressures to 1200 psi.

FOR COMPLETE INFORMATION ask for your copy of Catalog 7233.

- **IN DESIGN**
- **IN CONSTRUCTION**
- **IN PERFORMANCE**

HMTA

for pressures up to 1200 psi

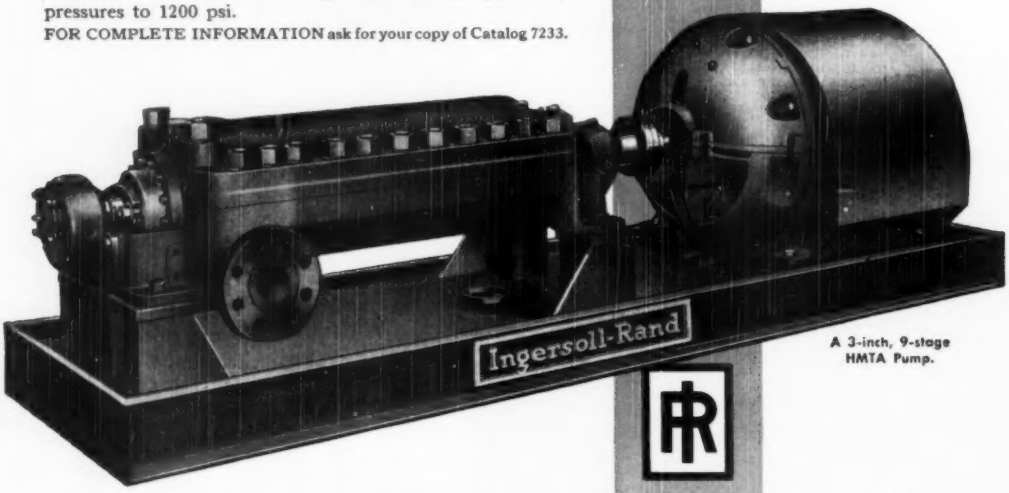
HIGHER SUSTAINED EFFICIENCY—made possible by perfectly-matched, self-aligning impeller and channel ring assemblies, with all running clearances proportioned for minimum wear.

EASIER MAINTENANCE AND LESS OF IT—with simplified, rugged construction throughout and easy accessibility of all parts.

SYMMETRICAL, MAXIMUM STRENGTH CASING—because the unit-type rotor assembly eliminates the need for a casing with intricate, cast volute passages.

LOWER PARTS INVENTORY—because maximum interchangeability of rotor-assembly parts makes it unnecessary to stock replacement units for each individual stage.

FLEXIBILITY OF OPERATION to meet changing load conditions—because pump characteristics can be altered by installing a new combination of rotor-assembly units.



A 3-inch, 9-stage HMTA Pump.

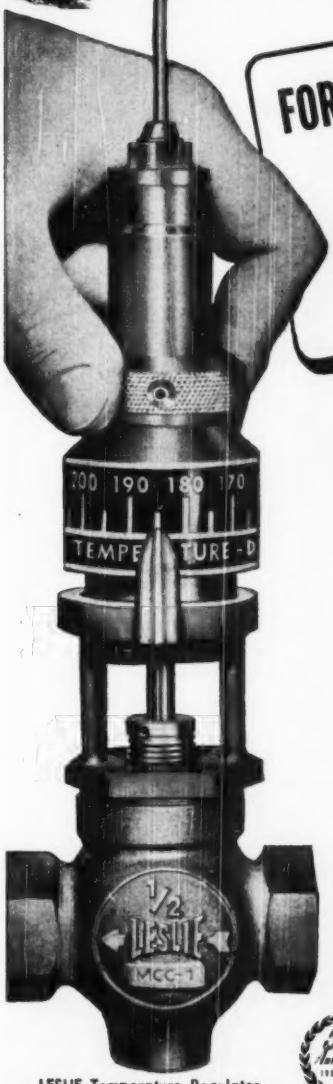
COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

Ingersoll-Rand

CAMERON PUMP DIVISION
11 BROADWAY, NEW YORK 4, N. Y.

550-10

FOR QUICK, EASY and DEPENDABLE TEMPERATURE SETTINGS... the NEW LESLIE Calibrated Dial is the Answer!



LESLIE Temperature Regulator
Class MCC—1 *(with Calibrated Dial)*

THE new **CALIBRATED DIAL** now available on Leslie Class T and Class M type Temperature Regulators provides quick, easy, and dependable temperature settings. A simple turn of the dial to the temperature desired is all that is needed.

This calibrated dial adds the following features to those which already make Leslie Temperature Regulators a great value:

★ **TIME SAVING**—*Just turn the dial to desired setting—no need to wait for equipment to heat up to find out if setting is correct.*

★ **SAFE**—*Avoids costly overheating caused by guess setting.*

★ **RUGGED**—*Designed for production line use where frequent dependable readjustments are necessary for process work.*

★ **SIMPLE**—*Fits in place of standard adjusting sleeve. No complicated linkages or gages to go out of order or add friction.*

Calibrated Dials are easily installed on Class T and Class M Regulators already in service.

LESLIE engineers are available by phone, mail or personal calls to give recommendations on your temperature regulation problems.

SEND FOR—copy of
Temperature Regulator Bulletin No. 464B

50th Anniversary 1900–1950

★ *Lowest Overall Cost per Operating Year*

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

Albany, N. Y.	Buffalo, N. Y.	Greensboro, N. C.	Milwaukee, Wis.	Pittsburgh, Pa.	Savannah, Ga.	
Albuquerque, N. M.	Chicago, Ill.	Greenville, S. C.	Minneapolis, Minn.	Ponca City, Okla.	Seattle, Wash.	
Atlanta, Ga.	Cincinnati, Ohio	Houston, Texas	Mobile, Ala.	Portland, Ore.	St. Louis, Mo.	
Baltimore, Md.	Cleveland, Ohio	Kansas City, Mo.	Monroe, La.	Providence, R. I.	Syracuse, N. Y.	
Beaumont, Tex.	Denver, Colo.	Kingsport, Tenn.	New Orleans, La.	Richmond, Va.	Tucson, Ariz.	
Birmingham, Ala.	Des Moines, Iowa.	Los Angeles, Calif.	New York, N. Y.	Rochester, N. Y.	Wilkes-Barre, Pa.	
Boston, Mass.	Detroit, Mich.	Louisville, Ky.	Orlando, Fla.	Rutherford, N. J.	Wilmington, Calif.	
Bridgeport, Conn.	Duluth, Minn.	Memphis, Tenn.	Philadelphia, Pa.	San Francisco, Calif.	Youngstown, Ohio	
Montreal, Que., Can.		Toronto, Ont., Can.		Vancouver, B.C., Can.	Brussels-Forest, Belgium	

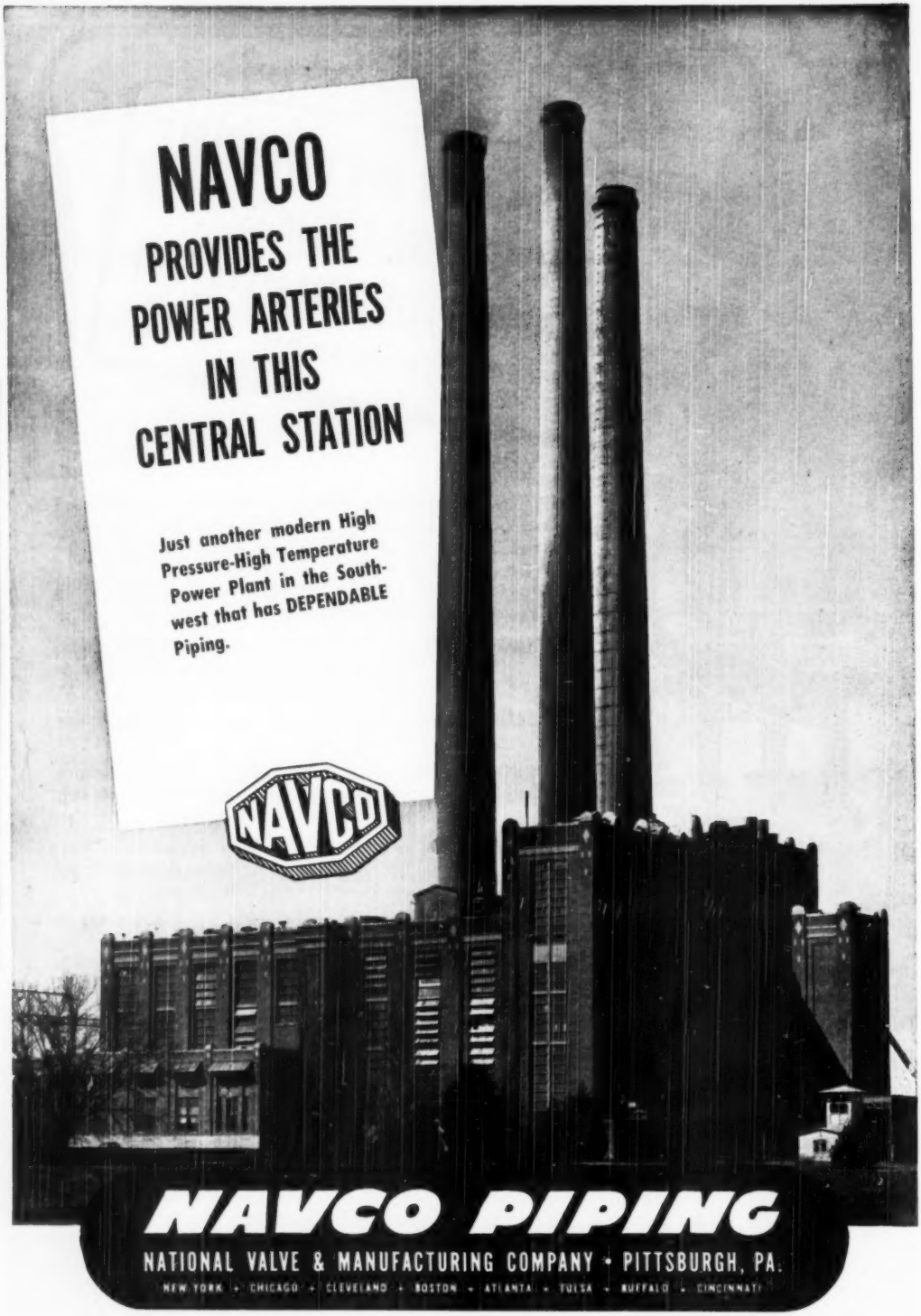
ESTABLISHED 1900

LESLIE CO.

235 Grant Avenue, Lyndhurst, New Jersey

FLOATLESS LEVEL CONTROLS
SELF CLEANING STRAINERS

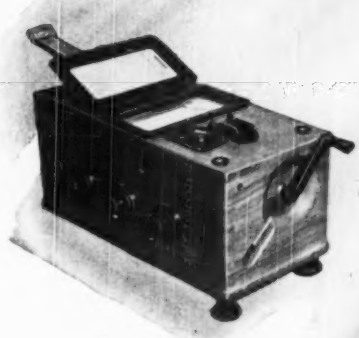
PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
• PUMP GOVERNORS • TEMPERATURE REGULATORS
• AIR HORNS • STEAM WHISTLES


NAVCO
PROVIDES THE
POWER ARTERIES
IN THIS
CENTRAL STATION
Just another modern High Pressure-High Temperature Power Plant in the Southwest that has DEPENDABLE Piping.
NAVCO
NAVCO PIPING
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

knowledge plus experience

. . . these have given him the surest instrument

. . . faith in himself



The BIDDLE business was and is being built on the faith of its customers in our ability to supply high quality instruments and personal service.

BIDDLE instruments enjoy the wide acceptance they do, because they have been dependable through long periods of service . . . They have been their own best salesmen. BIDDLE service files bear mute testimony to instrument after instrument that has served generations of workers . . . has amortized its purchase price long ago . . . and upheld the judgment of its original purchaser. Price tags and "specs" can't possibly reflect the quality or performance of a fine instrument or the integrity of its maker . . .

JAMES G. BIDDLE CO.
1316 ARCH STREET—PHILADELPHIA 7, PA.

Electrical Testing, Speed Measuring Instruments, Laboratory and Scientific Equipment — Established Since 1895

MEGGER® INSULATION AND RESISTANCE TESTERS • MEGGER GROUND RESISTANCE TESTERS • FRAHM® RESONANT REED TACHOMETERS • FRAHM RESONANT REED FREQUENCY METERS • JAGABI® TACHOMETERS AND SPEED INDICATORS • JAGABI LUBRI-TACT® RHEOSTATS

Look...compare...these **PREFERRED**

25-YEAR FEATURES* *at the Power Show*

SEE WHY ONLY PREFERRED OFFERS ALL 8!

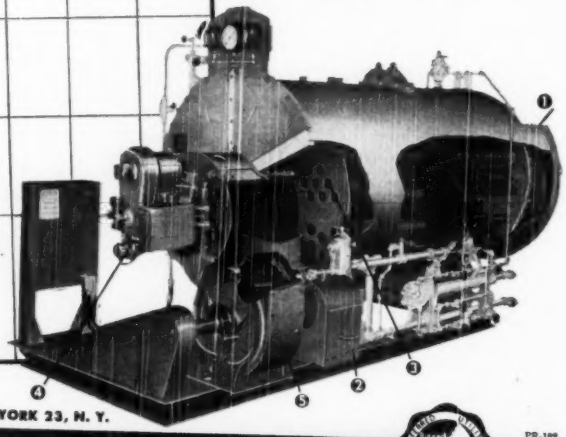
FEATURES	PREFERRED BOILER	BOILER A	BOILER B	BOILER C
❶ Anti-stress deck for tube sheet protection.	✓			
❷ Special *precipitator* developed by Preferred as aid to safe, clean operation.	✓			
❸ Staggered tube construction—minimizes possibility of tube pitting, even at *low* firing rates.	✓			
❹ 4700 rpm horizontal rotary oil burner with patented VOLUVALVE fuel regulation—designed and manufactured by Preferred—assures fully automatic operation even with No. 6 oil.	✓			
❺ Self-cleaning *induced draft* fan with air cooled shaft and bearings—assures long life	✓			
❻ Down-draft gas travel for 80% thermal efficiency—proved and guaranteed.	✓			
❼ Dual purging cycles for positive elimination of gas stratification.	✓			
❽ 4-pass, high velocity, gas travel —minimizes tube cleaning maintenance by self-cleaning action.	✓			

FIRST STOP FOR COMPARISON
PREFERRED'S
BOOTHS 60 & 61

*

Each distinctive feature of the Preferred Unit Steam Generator is designed to give efficient, economical service for an average of 25 years, with proper care and maintenance. You benefit by better performance . . . longer life . . . lower boiler costs.

If you are not able to attend the Power Show, be sure to get all the facts on the Preferred Unit Steam Generator. Send today for Bulletin 1000.

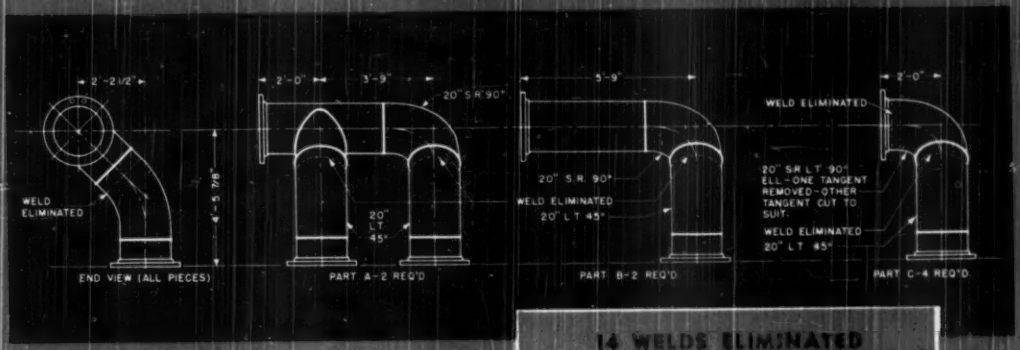


PREFERRED UTILITIES MFG. CORP., 1860 BROADWAY, NEW YORK 23, N. Y.

PREFERRED UTILITIES MFG. CORP.

PR-198

12% COST REDUCTION... *in these piping subassemblies*



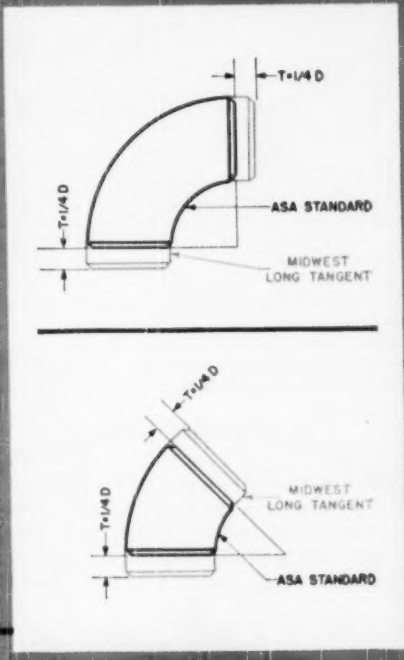
14 WELDS ELIMINATED
7'-8" OF 20" PIPE SAVED

with MIDWEST "LONG TANGENT" ELBOWS

Here is a concrete example of the extra cash value of Midwest "Long Tangent" Elbows. They saved 12% of the cost of this piping.

Each of the subassemblies shown above, if made of ASA elbows, would have required an extra nipple with an extra weld at the dotted line. With the Midwest Long Tangents, both the nipples and the welds were eliminated. Reduced material and labor costs made this substantial saving.

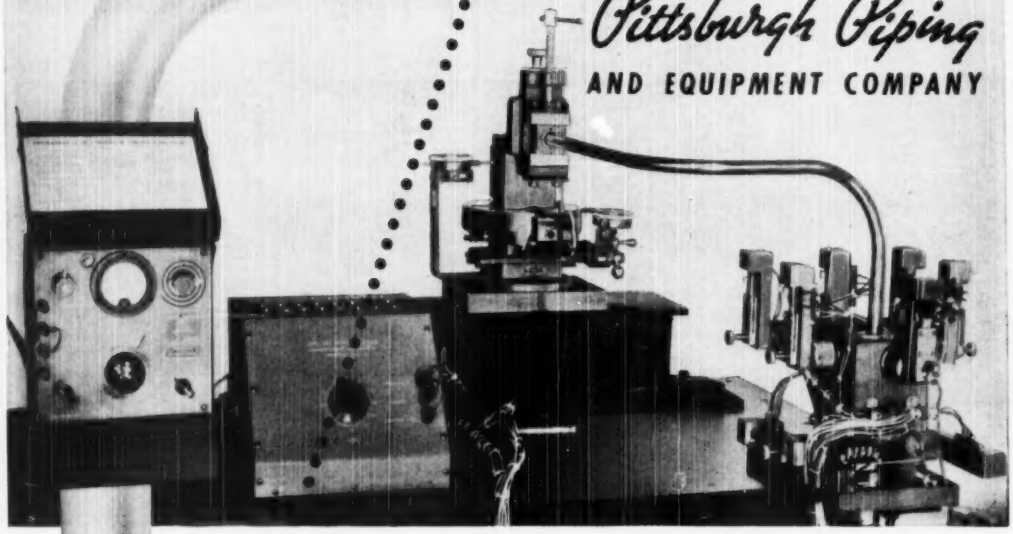
Other advantages of Midwest "Long Tangent" Elbows: pipe and fitting lined up more quickly and accurately, weld is removed from point of maximum bending stress, can be sleeved, slip-on welding flanges are more easily used, and they cost no more than standard elbows usually furnished. Ask for Catalog 48.



MIDWEST WELDING FITTINGS
Improve Piping Designs and Reduce Costs

MIDWEST PIPING & SUPPLY COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Houston • Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St. Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave. • Tulsa 3—234 Wright Bldg. • Boston 17—470 Pine St.

Model Testing at Pittsburgh Piping AND EQUIPMENT COMPANY



The Modern Method for Complete, Practical Pre-determination of Piping Flexibility

Model testing is one of the many technological advancements thoroughly investigated and proved by Pittsburgh Piping and Equipment Company before being made generally available. It provides complete advance knowledge of the reactions of any type, size, and system of power piping.

The testing apparatus shown above accurately measures and directly indicates the physical reactions of a section of pipe which exactly duplicates, in miniature, the planned layout. These measurements are projected to give precise information on the full size system as a check against theoretical calculations.

On complex piping layouts, model testing provides a complete analysis instead of theoretical approximation; it is a time and labor saver; and the possibility of mathematical error is minimized. Its use helps to avoid excessive stresses, reactions, and movements in the final system which could affect joints and thus cause leakage, or damage anchors and equipment connected to the pipe line.

Look to Pittsburgh Piping and Equipment Company for leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

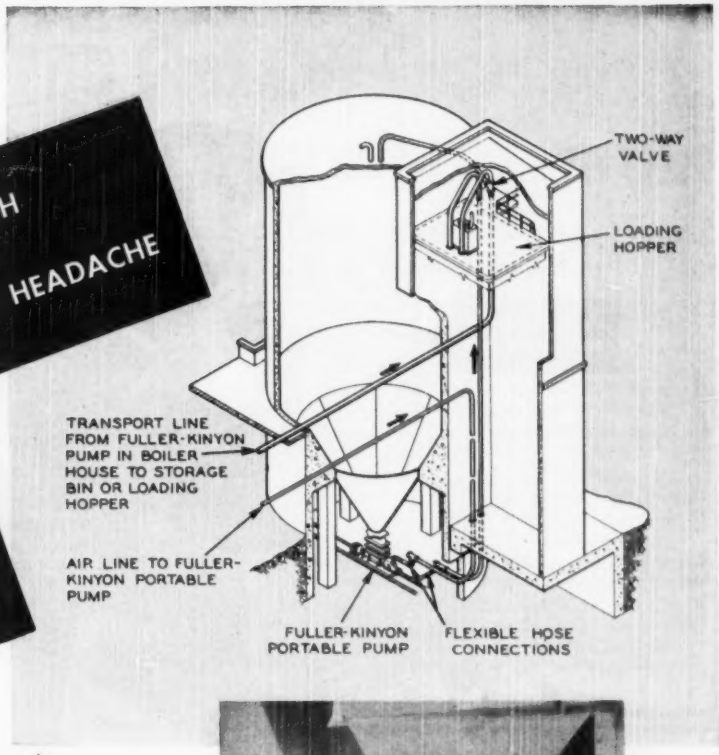
Model Testing makes possible the planning of high-pressure, high temperature piping systems with accurate advance knowledge of end reactions, stresses, and strains encountered in actual operation.

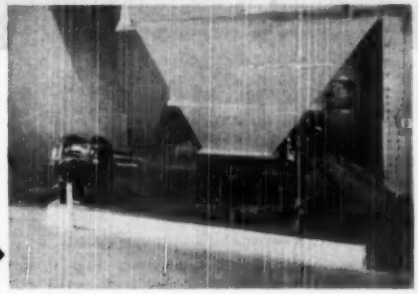
Pittsburgh Piping AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston

FLY ASH WAS A HEADACHE


TWO-WAY VALVE
LOADING HOPPER
TRANSPORT LINE FROM FULLER-KINYON PUMP IN BOILER HOUSE TO STORAGE BIN OR LOADING HOPPER
AIR LINE TO FULLER-KINYON PORTABLE PUMP
FULLER-KINYON PORTABLE PUMP
FLEXIBLE HOSE CONNECTIONS



Fly-ash storage and handling facilities. Fuller-Kinyon Portable Pump for conveying from present storage bin, or future bins, to loading hopper for bulk-car loading.

Fuller-Kinyon Stationary Pump installed in boiler house.

Fly ash, once a nuisance to generating stations, is becoming a source of profit today. Now, concrete products manufacturers are using large quantities of it—and demanding even more.

Handling this once-valueless waste was a tough, dirty, expensive job—until Fuller-Kinyon pumps took over the task of conveying it. From collector hoppers to storage bins or to bulk-car loading hoppers—Fuller-Kinyon pumps convey fly ash and send it anywhere, cleanly, efficiently, around corners, in any direction.

If your plant produces fly ash, in quantity, call in a Fuller Engineer. He'll discuss recovery and disposal—recommend whatever equipment may be needed. There is no obligation.

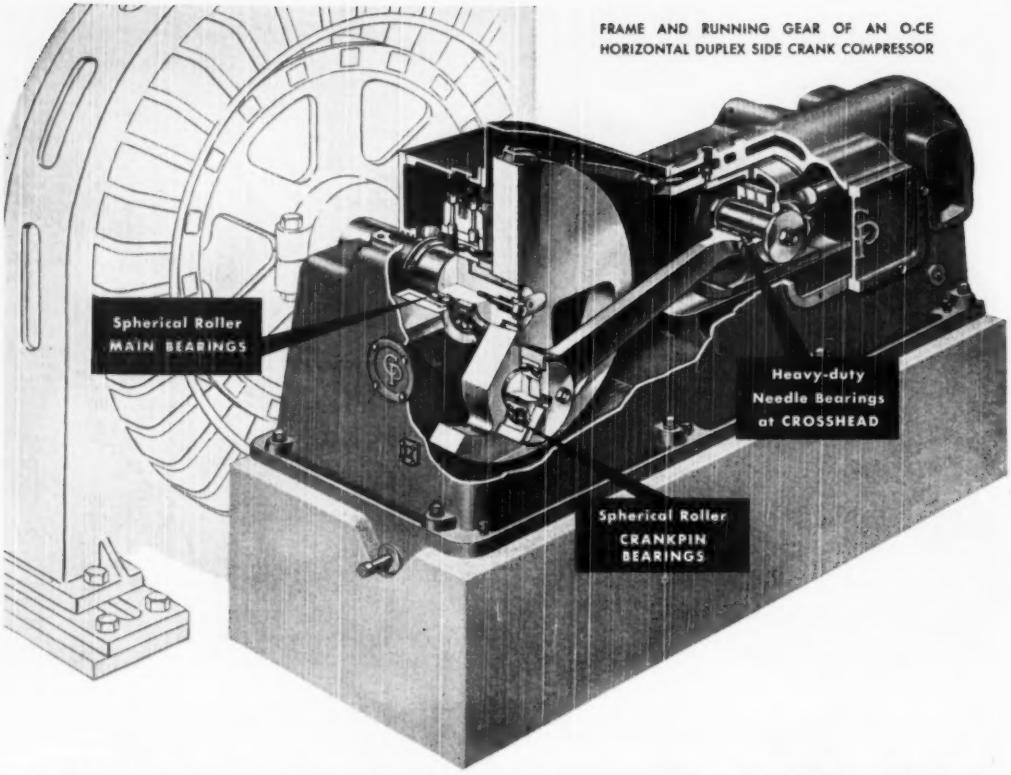
FULLER COMPANY, Catasauqua, Pennsylvania • Chicago 3—120 So. LaSalle St. • San Francisco 4—420 Chancery Bldg.

fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS • COMPRESSORS AND VACUUM PUMPS • FEEDERS AND ASSOCIATED EQUIPMENT

F-126

7257



FRAME AND RUNNING GEAR OF AN O-CE
HORIZONTAL DUPLEX SIDE CRANK COMPRESSOR

FIRST WITH ROLLER BEARINGS THROUGHOUT

IN A HORIZONTAL DUPLEX COMPRESSOR

- SPHERICAL ROLLER MAIN BEARINGS
- SPHERICAL ROLLER CRANKPIN BEARINGS
- HEAVY-DUTY NEEDLE BEARINGS AT CROSSHEAD

Chicago Pneumatic's Class O-CE AIR COMPRESSORS are the first horizontal duplex, side crank compressors to have anti-friction roller bearings throughout . . . spherical roller main and crankpin bearings . . . heavy-duty needle bearings at the crosshead pins.

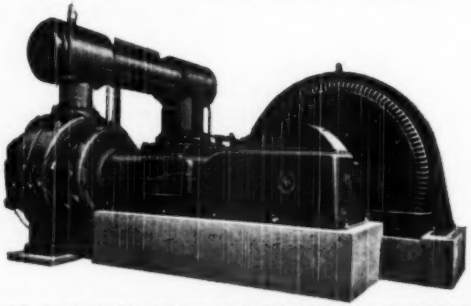
To the user, "roller bearings throughout" means easier and cheaper maintenance, and no possibility of improper bearing adjustment with resultant serious damage to frame and running gear.

Roller crankpin bearings permit the use of solid-end connecting rods—the strongest, safest type.

This revolutionary innovation is made possible by the recent development of the oil injection method of bearing and crank disc installation and removal. This simple method, requiring only a hand-operated oil pump and ordinary hand tools, is employed also for the application or removal of gears, couplings and sleeves on shaft ends.

Class O-CE Motor-driven Compressors are furnished in sizes up to 2000 h.p.

Write for Bulletin 726-5



CLASS O-CE TWO-STAGE MOTOR-DRIVEN COMPRESSOR

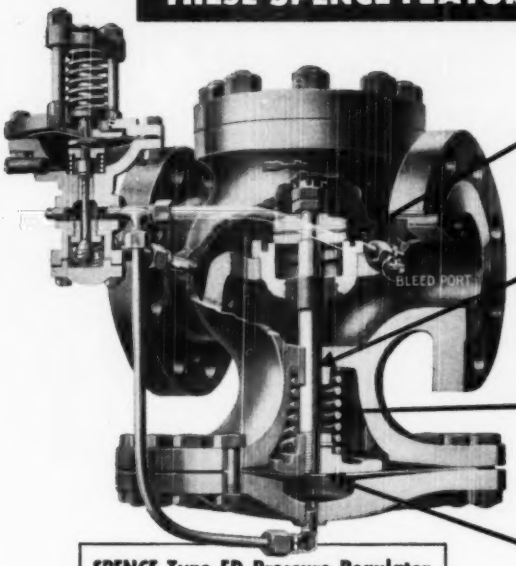
CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

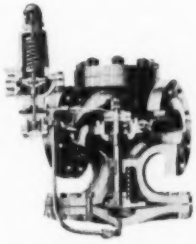
SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

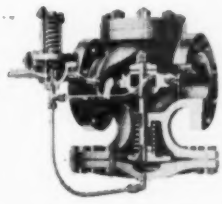
YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.

Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

GARLOCK MECHANICAL SEALS FOR *Rotary Shafts*

Where leakless operation of rotary shafts on pumps or other equipment is required, GARLOCK MECHANICAL SEALS will do the job.

There is no wear on the shaft when a Garlock seal is used. Sealing is effected by leakless and positive contact between carefully lapped metal-to-carbon or metal-to-metal mating surfaces. One of these elements rotates with the shaft and the other is stationary. The stationary element does not contact the shaft.

These precision-built seals are made in several standard designs and in a wide range of highest grade materials. The selection of design and materials depends upon the service in which the seal is to be used. If none of our standard designs appears entirely suitable for any specific application, a modification of a standard design or a specially designed seal will be engineered and built for that job.

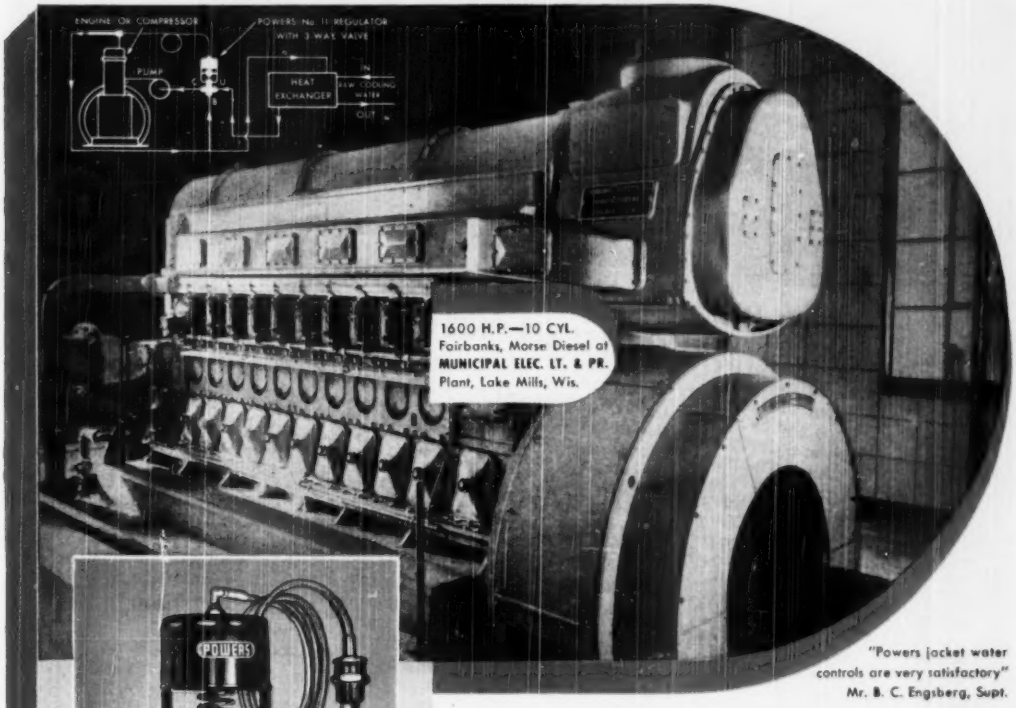
Thousands of GARLOCK MECHANICAL SEALS have proved their effectiveness, durability and economy on shafts operating at high and low speeds and pressures. Users of Garlock seals are enjoying many months—or years—of trouble-free operation on equipment handling various liquids such as, for example, water, gasoline, beer, acids and paint.

If you need Mechanical Seals for any kind of a rotary shaft application, let Garlock's experienced engineering staff work with you. Write for our Mechanical Seal booklet.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

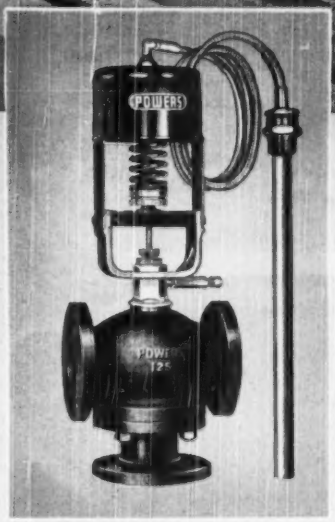
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK



1600 H.P.—10 CYL. Fairbanks, Morse Diesel at **MUNICIPAL ELEC. LT. & PR.** Plant, Lake Mills, Wis.

"Powers jacket water controls are very satisfactory"
Mr. B. C. Engsberg, Supt.



POWERS No. 11 REGULATOR, Self-Operating, with 3-Way Water Mixing Valve

Provides dependable, economical control of jacket water temperature. Is used on either soft or raw water supply. Also available with direct or reverse acting valve. Drawing above shows only one of many possible combinations. Pneumatic controls also available.

POWERS
TEMPERATURE CONTROL

POWERS—Jacket Water Temperature Control Improves Combustion and Efficiency Reduces Fuel and Lube Oil Consumption

Costs less than a set of new piston rings. Often pays back its cost the first year. Helps prevent the danger of piston seizure.

Dependable control of jacket water temperature is assured by a POWERS regulator which automatically compensates for load changes. Accurate temperature control results in better lubrication, longer cylinder liner wear and fewer piston ring replacements.

Whether you want a simple self-operating regulator, like the one shown here, or pneumatic controls we can supply both. Why not have a Powers engineer call and study your requirements for better temperature control? There's no obligation. With almost 60 years of experience we may be able to help you select the type that will give best results. THE POWERS REGULATOR CO., Offices in Over 50 Cities. See your phone book.

FILL IN AND MAIL TODAY (D11)

The Powers Regulator Co., 2771 Greenview Ave., Chicago 14, Ill.

Have engineer call to study our requirements for better jacket water temperature control.

Name of Engine or Compressor ..... HP .....

Your Name .....

Address .....

City ..... State .....

JETS GET FLEXIBILITY JOB SPEEDS AHEAD

PENFLEX FLEXIBLE METAL HOSE PROVIDES EFFICIENT, TIME SAVING SERVICE AS JET FEEDER LINES ON TUNNEL PROJECT

Down with a 14,000 ton caisson seventy feet into a sand island. Jet feeder lines had to be flexible to transmit water at high pressure up and over the top and down to the jets at the bottom of the caisson.

As the caisson settled, the constant changing of the top level made flexibility a "must" for these jet feeder lines. Penflex "flexineering" had the answer . . . the problem ended.

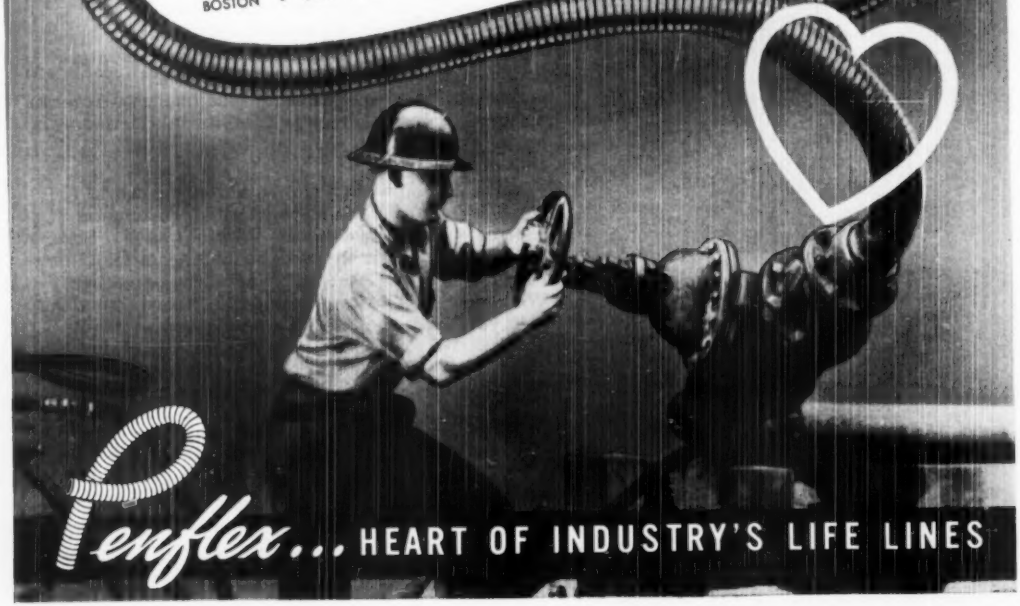
Penflex 4" interlocked, flexible metal hose was installed. Connecting and disconnecting rigid pipes was eliminated . . . time saved . . . labor saved . . . and the job speeded up.

Penflex hose is tough, rugged tubing that is tight as a pipe . . . resists high pressures . . . . yet provides all of the flexibility necessary for the job.

Whether your problem is the transmission of liquids, volatiles, granular material or taking the vibration out of exhaust and air lines . . . or even the protection of fine lead wires on instruments, "flexineering" has the answer for you. Penflex engineers will be glad to work with you in the application of tubing from 1/8 inch I.D. on up to 24 inch I.D. Write today for your copy of "FLEXINEERING."

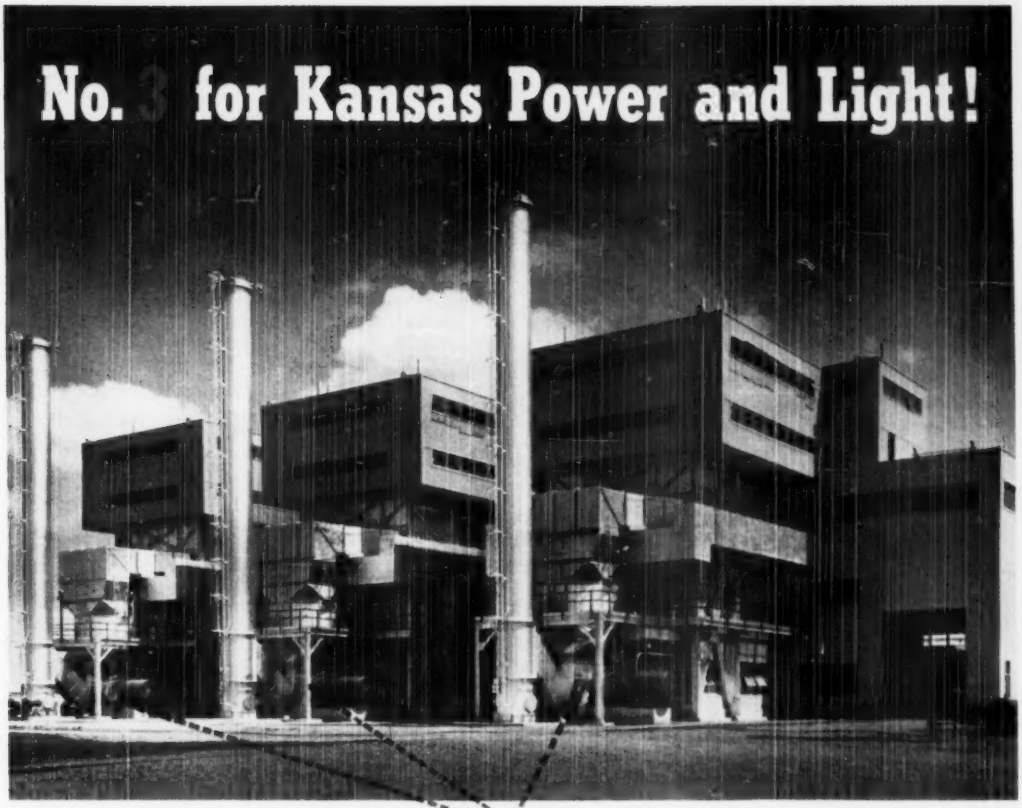
Pennsylvania Flexible Metallic Tubing Company, Inc.
7238 Powers Lane, Philadelphia 42, Pennsylvania

Branch Sales Offices
BOSTON • NEW YORK • CHICAGO • HOUSTON • CLEVELAND • LOS ANGELES

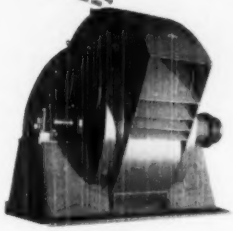


Penflex... HEART OF INDUSTRY'S LIFE LINES

No. 3 for Kansas Power and Light!



It's pretty difficult to beat repeat orders as proof of performance. First at Abilene . . . then at Topeka . . . and now at Hutchinson, Kansas Power & Light has made its third installation of 'outdoor-enclosed' E-M Magnetic Drives for precise speed control of draft fans.



One of the three 440 HP 875 RPM E-M Magnetic Drives with outdoor enclosures installed at the Hutchinson Station of Kansas Power and Light Co.

When the automatic E-M Regutron Controls call for more or less draft, the E-M Magnetic Drives instantly respond to change fan speed . . . and keep that speed within 1% . . . regardless of load variations.

The E-M Magnetic Drive with Regutron Controls gives the correct air for efficient combustion . . . effects fuel savings . . . holds combustion losses to irreducible minimum.

Learn how you, too, can save on power and fuel bills in your power plant with "economy-engineered" E-M Magnetic Drives. Call, write, or wire your nearest E-M engineer, or write for E-M Publication No. 1078.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

4400-TPA-2094

E-M

ADJUSTABLE-SPEED
MAGNETIC DRIVES

ERIE CITY 3-Drum Boiler

Exceeds Predicted Efficiency of 84.56% at Mueller Brass Co.

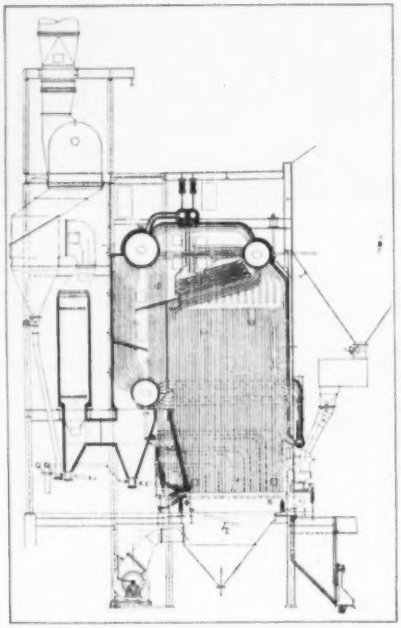
BOILER NO. 6 at Mueller Brass Co., Port Huron, Mich., an Erie City 890 h.p. 3-drum boiler, outdoor installation, designed for 675 psi, was recently given a 21 hour test under normal operating conditions.

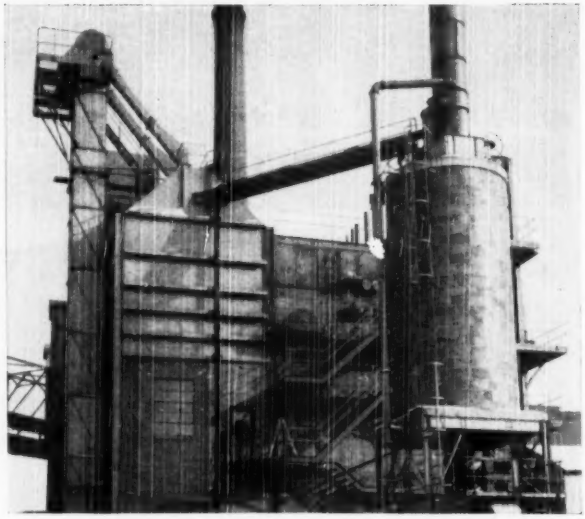
During this test the records show that 121,311 pounds of coal produced 1,156,400 pounds of steam, an evaporation rate of 9.53 pounds of steam per pound of coal, an efficiency of 88.5%. A computed heat balance based on CO_2, flue gas and other test readings, indicate an efficiency of 85.15%. Either figure shows that the prediction was surpassed by a comfortable margin.

The Erie City Steam Generator, complete with water walls, economizer and superheater, is stoker fired with Ohio Strip Mine Coal of 11,513 B.T.U.

Boiler and Water Walls	11,600 sq. ft. Heating Surface
Economizer	7,344 sq. ft. Heating Surface
Superheater	500° F.
Furnace Volume	5,500 Cu. ft.
Stoker	190.7 sq. ft. (effective)

For a detailed report on the complete test performance, write for bulletin SB-40.





Erie City 890 hp. 3-Drum Outdoor Type Steam Generator at MUELLER BRASS CO., Port Huron Mich.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators • Type C 3-Drum Boilers • Types VL & VC 2-Drum Boilers • "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • "Keystone" Packaged Steam Generators • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

fireye **Flame Failure Protection**

At the Massachusetts Institute of Technology, where research is the order of the day, Fireye Flame Failure Safeguards were chosen to guard the boilers in the main power plant . . . chosen by engineers trained in modern industrial research . . . chosen to insure the uninterrupted research which guards our nation's security.

Fireye Flame Failure Safeguards have set new standards of safety for industrial gas and oil burning boilers. Get the whole story. Write today for Bulletin 604-E.

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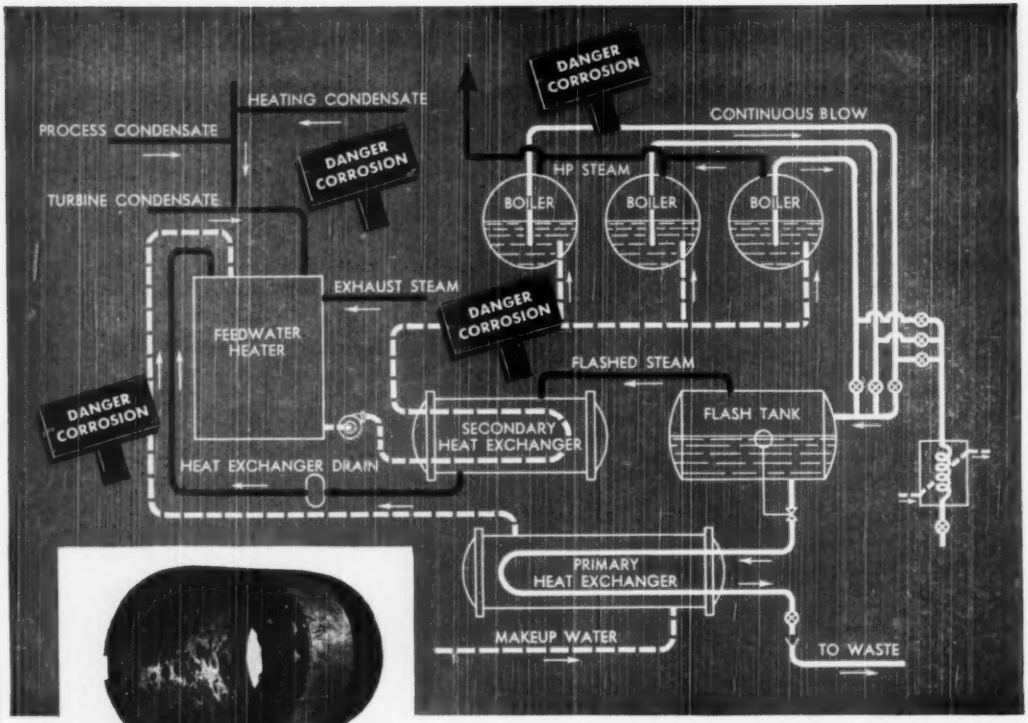
COMBUSTION CONTROL CORP.

Flame Failure Safeguards for Oil and Gas Burners
Photoelectric Smoke Indicators

77 BROADWAY, CAMBRIDGE 42 MASS



AVOID These Danger Signs with BIRD-ARCHER Amine Treatment

CORRODED condensate return lines lead to expensive pipe replacement and maintenance. As an added annoyance, the solid products of corrosion often plug return lines and fill traps. You can steer clear of these troubles by using the *effective, economical* Bird-Archer Amine Treatment.

HERE'S THE WAY THIS B-A TREATMENT WORKS

Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself.

HERE'S HOW THIS B-A TREATMENT SAVES MONEY

Raising the pH value of the condensate severely decreases maintenance costs by eliminating corrosion. These savings may more than offset the amount of treatment required to provide protection for your equipment.

NEW BULLETIN gives full details on the Bird-Archer Amine Treatment. . . . contains case histories that prove its successful application in many plants. *Write for your copy today.*

BA-154

WHAT AMINES ARE

Amines are members of a class of chemical compounds in which one or more hydrogen atoms of the ammonia molecule are substituted by an organic group. Some of the simpler types are soluble and volatilize from boiler waters. The alkalinity of the amines is an inherent property and does not result from decomposition. *No free ammonia is released.* In the concentrations necessary for protection of condensate systems, amines are harmless to non-ferrous metals, non-toxic and are completely stable at temperatures approximating 675F.

BIRD·ARCHER
WATER TREATMENT

LABORATORIES ENGINEERS CHEMISTS

THE BIRD-ARCHER COMPANY, 400 MADISON AVE., NEW YORK 17, N. Y.
Philadelphia, Pennsylvania • Chicago, Illinois • Montreal, Canada
CALDERAS Y ACCESORIOS, S. A. AMSTERDAM 291, MEXICO, D. F.

Now— by AMBERLITE MONOBED DEIONIZATION

ZERO SILICA • ZERO HARDNESS • ZERO CARBON DIOXIDE

ZERO TOTAL IONIZED SOLIDS

without Evaporation!

High-pressure-boiler feedwater—passed *once* through a *single* bed of AMBERLITE ion exchange resins—is free of silica, hardness, carbon dioxide . . . of essentially all ionized solids.

No fuel is consumed, no heat is lost, no shutdowns for cleaning are needed. The cost of equipment—and of its operation—is low. The treated water contains less than one-tenth of one part of ionized solids per million parts of water—no matter how poor the quality of your raw water supply. And alkalinity is . . .

But we're getting ahead of our story.

Here's a better way to tell it. First, clip the coupon at the bottom of this page, fill it in, and mail it to us. When you've had a chance to read the booklet, ask your consulting engineer or manufacturer of water conditioning equipment how AMBERLITE Monobed deionization can insure the life and efficiency of your high-pressure boilers. Or, if deionization in *one* ion exchange unit doesn't quite suit your special needs, ask him how high quality water can be produced by various combinations of AMBERLITE cation and anion exchange resins, operating in *separate* units.

CHEMICALS FOR IND

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square Philadelphia 5, Pa.

The Resinous Products Division was formerly The Resinous Products & Chemical Company

AMBERLITE is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.

ROHM & HAAS COMPANY

Washington Square, Philadelphia 5, Penna.

Please send me your new 16-page booklet, "AMBERLITE Monobed Deionization".

Name_____

Title_____

Company_____

Address_____

City_____ State_____

this v-belt inventory is unnecessary

Standardize on Veelos—the adjustable v-belt—and *eliminate* the storage problem, the control problem and the "tied-up" money problem that is usual in maintaining a full stock of endless v-belts.

this stock of VEELOS replaces up to 316 sizes of endless v-belts

Four reels of Veelos can take care of *every* v-belt need in the O, A, B and C widths. V-belt control is simplified, only a minimum storage space is needed and inventory-dollars are kept at rock bottom.

this VEELOS v-belt drive steps up production

Veelos supplies vibrationless, full power delivery and can be simply and easily adjusted to maintain uniform tension on all belts. Veelos can be installed quickly . . . even without dismantling outboard bearings.

this handy Veelos Data Book

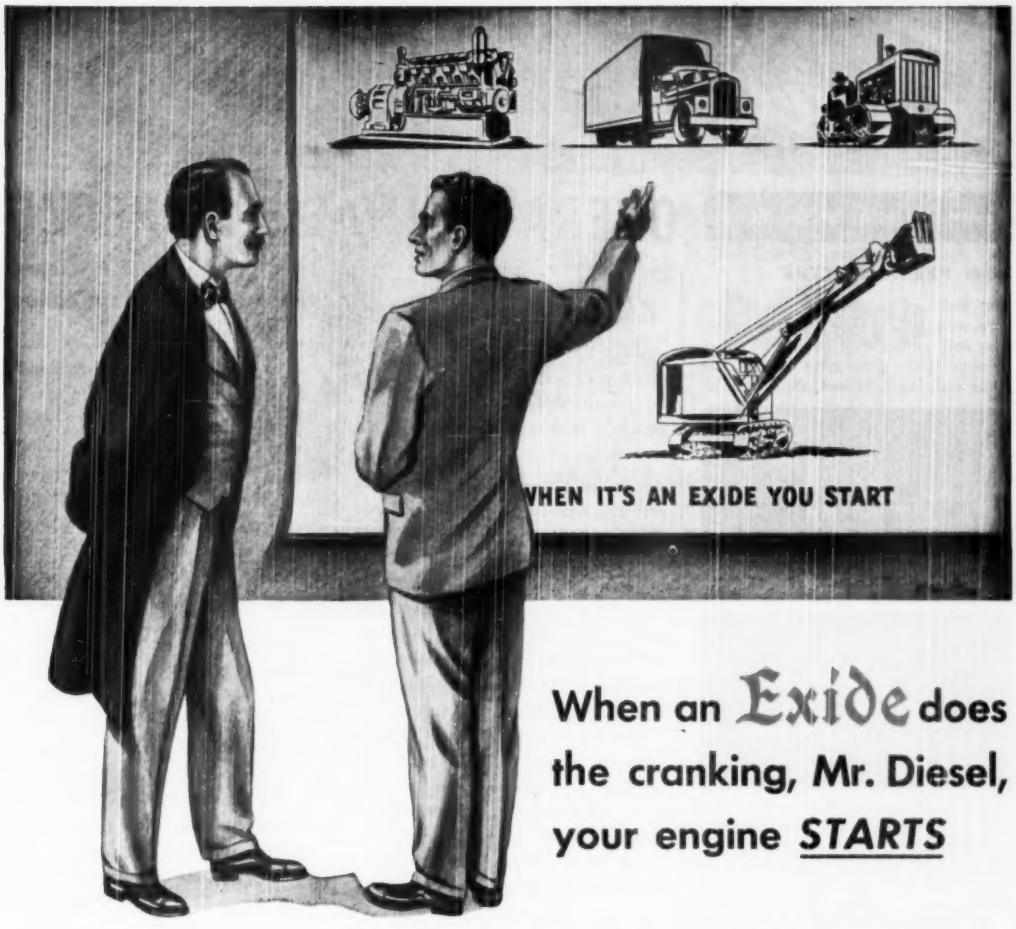
should be in your files ready for instant reference . . . it contains the facts on Veelos V-Belts. Write for your copy now.

VEELOS
THE LINK
V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

MANHEIM MANUFACTURING & BELTING COMPANY, MANHEIM, PA.



When an Exide does the cranking, Mr. Diesel, your engine *STARTS*

You can count on sure starting, because an Exide Battery is built specifically for the job . . . built to deliver the mighty surge of cranking power a Diesel engine needs.

Whether you're a manufacturer or operator of Diesel engines and Diesel-powered equipment, that means you can depend on your Exide Diesel Cranking Batteries for:

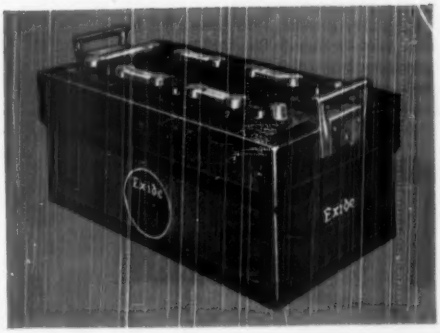
- high maintained voltage—a *quick breakaway* and *high cranking speeds.*

You also get:

- long life—low depreciation, less frequent replacements.
- low costs—operating, maintenance, repair.
- rugged construction, for heavy-duty service in all climates.

For maximum economy and dependability, use Exide Batteries for all your Diesel cranking—buses, trucks, trailer-tractors, off-the-highway equipment, ships, power plants, Diesel-electric locomotives.

TO HELP YOU GET TOP CRANKING performance, Exide's Engineering Staff, the largest in the industry, will be glad to help you solve any of your Diesel-cranking problems.



THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

"Exide" Reg. Trade-mark U.S. Pat. Off.

1888 . . . DEPENDABLE BATTERIES FOR 62 YEARS . . . 1950

Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Expansion Joint of the Month

OPERATION D-E-E-P FREEZE

LOW PRESSURE TYPE

The Zallea Low Pressure Corrugated Expansion Joint is used to absorb vibration and protect machinery. Made of stainless steel, these joints are of the non-equalizing type and are limited in

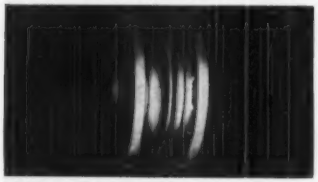


Figure 7

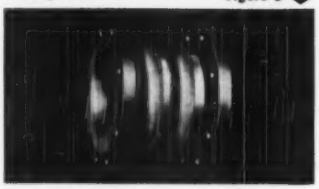


Figure 8

service to ½" maximum axial movement and 50 lbs. maximum working pressure. Furnished with a single corrugation (Figure 7), or with multiple corrugations (Figure 8), they are primarily used on condensers, turbines, stage bleeders, pumps, and between connected equipment where slight movement and vibration occurs. Industry, with its increasingly high temperature problems, relies on the Zallea Low Pressure Corrugated Expansion Joint for smooth flow and maximum operating performance. For your expansion problem, always specify the *best* in expansion joints . . . specify *Zallea*, you'll find it pays!

The supply is going fast . . . send *TODAY* for your copy of Catalog 47, a text book and valuable reference source on all Zallea Expansion Joints.

ZALLEA BROTHERS, 814 Locust Street, Wilmington 99, Delaware

Our Readers Ask

Q. *A friend and I recently had a friendly argument over copper vs stainless steel expansion joints. What are your views? A. T. M., Conshohocken, Pa.*

A. Except where corrosive conditions prevent, stainless steel may be used wherever copper is used. Although slightly more expensive in its initial cost, the use of stainless steel will result in much lower overall cost because of its increased life. Having approximately three times the tensile strength of copper, stainless steel elements can be made with a wall thickness approximately ⅓ that required for copper to withstand the same working pressure. As the life of a corrugated element varies inversely with the thickness of the element, a stainless steel expansion joint will last several times longer than a copper expansion joint designed for the same operating pressure.

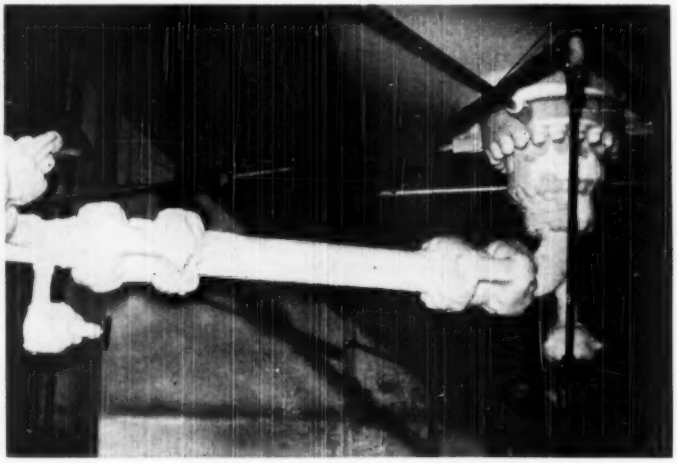
Your questions are welcomed. Address all letters to Engineering Dept. 917.

Temperature and Pressure Problem Solved by Zallea

Recently Zallea engineers were faced with a problem of developing expansion joints for operation on a liquid oxygen line, operating at —320° F., under extreme pressure at a large classified government facility. Because of the unusual nature of this installation, Zallea engineers designed *both* the piping layout and the expansion joints. Special stainless steel alloys were selected for the expansion joints to withstand the severe operating conditions.

Zallea Joints Tested

Shown here in operation, under a heavy layer of frost, are two of a group of 14 six inch Zallea Toroidal Hinged Type Stainless Steel Expansion Joints, with stainless steel construction throughout including the hinges and flanges. Prior to shipment, these Zallea Stainless Steel Expansion Joints were factory-tested to 1400 pounds hydrostatic pressure for a period of 8 hours to insure long life and satisfactory job performance.



$1,000
Cost of a New Elgin "Double-Check" Softener $1205.00*
Cost of making your present softener into a "Double-Check" $130.00
Cost of added zeolite 71.00
201.00*
Savings
$1004.00

Here's an easy way to make a Thousand Dollars

Get added soft water without buying a new softener

One of the best ways to make money in business (too often overlooked today) is to *cut costs*. Note, for example, what the simple arithmetic above can mean to you.

Suppose, for instance, you have a zeolite water softener (of any make) that isn't doing its job right. Or suppose you need more soft water, and that you have considered buying a new softener. If the softener you contemplated buying happened to be of the popular size assumed in this example*, it would cost you exactly $1205.00 to replace it with the advanced Elgin "Double-Check" Water Softener—a mighty fine investment if your old softener is beyond modernization . . . *but*—

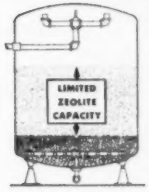
If, as in so many cases, your present softener is in basically useable condition, as little as $201.00 will pay for installing Elgin "Double-Check" Manifolds and adding Zeolite necessary to convert it into the equivalent of that new $1205.00 Elgin Softener. That *IS* an easy way to make a thousand bucks!

Make? No, more properly we should have said *save* a thousand; for you would actually *make* more than that because the greater capacity and lower operating cost of your Elgin modernized softener would quickly pay its small remodeling cost and then pile up additional savings year after year.

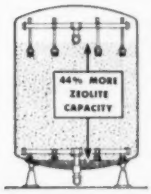
Thousands have profited by the Elgin modernization program. If you doubt this, simply mail the coupon below and let us send you complete information which you can consider in terms of your own conditions.

ELGIN SOFTENER CORPORATION
130 N. Grove Ave., Elgin, Ill.

Elgin dollar-saving modernization explained:



BEFORE—
limited capacity ..
Your present softener (regardless of make) is basically as diagramed opposite. Its conventional manifold design restricts it to a shallow zeolite bed and a slow back-wash rate to prevent the escape of costly zeolite to the drain.



AFTER—
large capacity
This is the way your softener would be arranged when remodeled with Elgin "Double-Check" Manifolds. The "Double-Check" arrangement prevents escape of zeolite; permits far deeper bed and higher back-wash rate. The extra zeolite means extra soft water and the higher back-wash rate means better regeneration, more efficient use of more zeolite.

Net result is up to 44% more soft water, but this, mind you, assumes the same kind of zeolite. If, as in so many cases, your present zeolite is the old ineffective type, total replacement of it with Elgin high capacity zeolite may step up your soft water output *three to ten times*.

*In this typical example we have chosen the initial price of a New Elgin Softener of popular size and compared it with the cost of its remodeled equivalent. The saving would be greater if the modernized softener were larger; less, if a smaller size were remodeled. If the zeolite were completely replaced the cost of zeolite would be greater, but if total replacement were needed the greatly increased soft water output would more than justify its slight additional cost.

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Economical WATER CONDITIONING FOR EVERY NEED
SINCE 1908

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Cleaver-Brooks steam boiler quality is the sum of many qualities. From the rolling-in of the first tube and through every step to completion, the highest standard of engineering, material and workmanship prevail. Every component is the tested product of a manufacturer of known standing — carefully selected by Cleaver-Brooks engineers through test and research.

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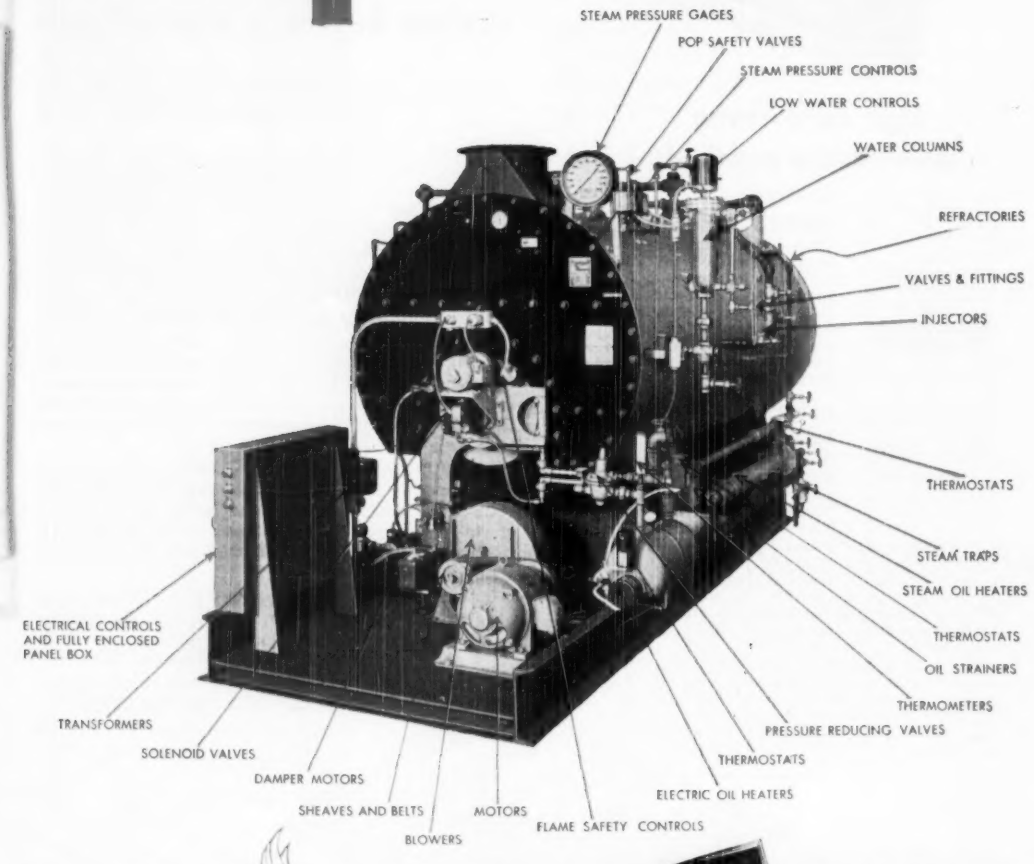

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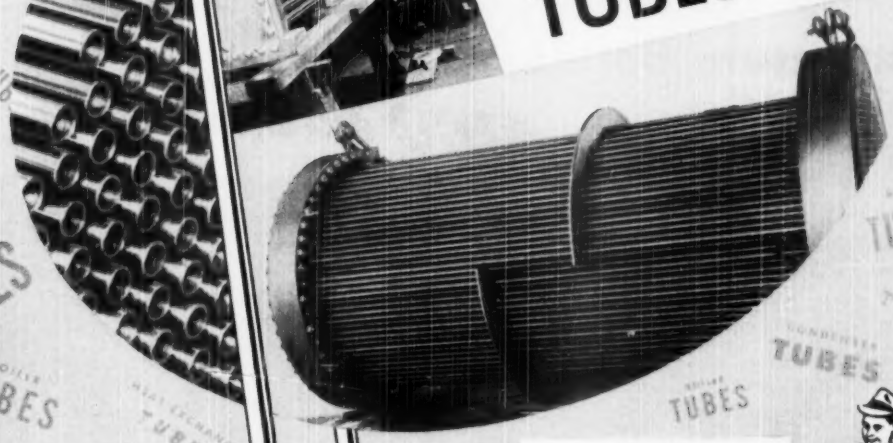
heat exchanger and condenser
TUBES



QUICK SERVICE on your tubing requirements for original equipment or replacement is available from your nearest B&W Tube representative and through local distributors in principal cities.

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TA-1523-C

Engineering & Construction by Gilbert Associates—Reading, Pennsylvania

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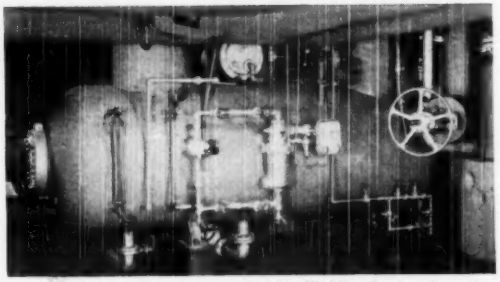
Typical of this efficiency is an ALCO evaporator of new design which performance tests show will produce vapor with maximum solids carryover of 0.5 ppm or less. Such ALCO features as a special vapor scrubber and an exclusive integral deaerating heater insure top performance of this unit. The deaerating section, for example, is fully effective so that ALCO guarantees feedwater leaving this section to have zero free carbon dioxide content and 0.03 cc. of oxygen per liter.

Check these other Alco design features . . . exclusive "flex-tube" action for descaling . . . separate, removable channel and cover . . . patented ALCO compression bolting . . . all add to the efficiency of the evaporator. Write now for more details or call the nearest ALCO Sales Engineer at Chicago, Cleveland, Houston, Kansas City, Los Angeles, New York or Tulsa. Plants at Dunkirk, N. Y. and Beaumont, Texas.



New design ALCO Evaporator on the job at Hickling Station. Capacity, 7000 pounds of water per hour at 238.3° F. and 24.2 p.s.i.a. when supplied with steam at a pressure of 56.5 p.s.i.a.

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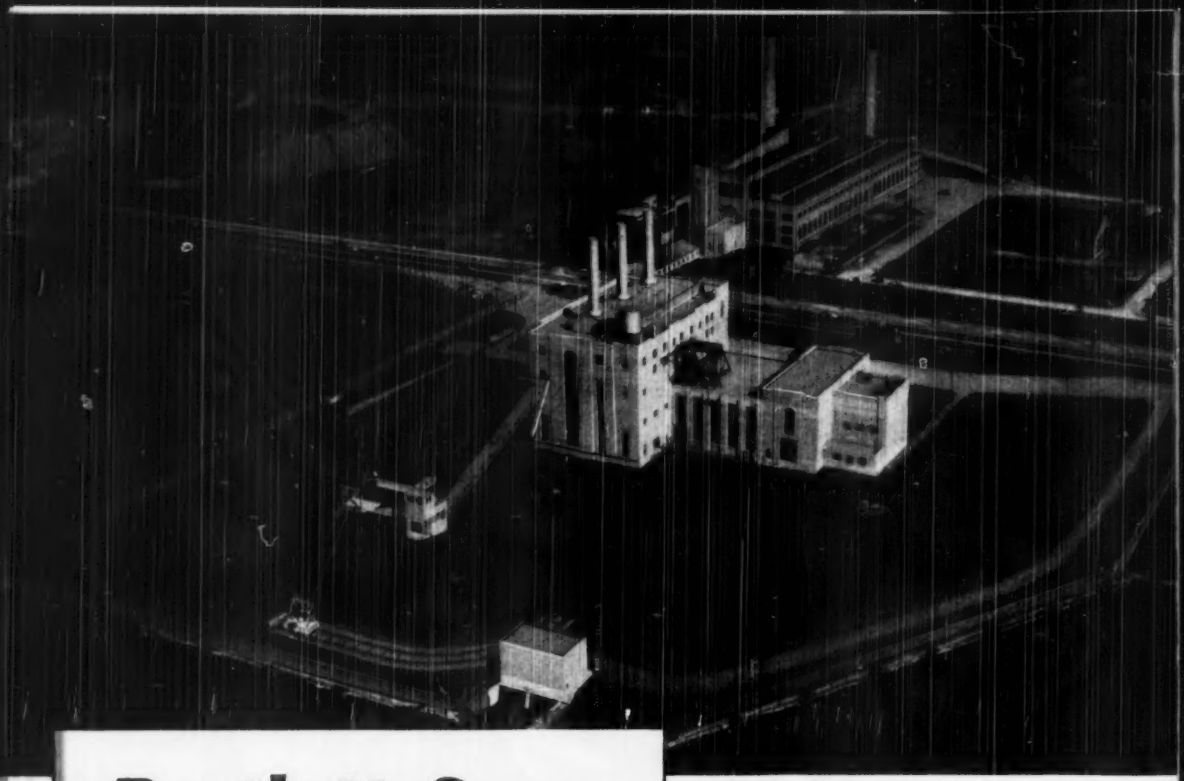

General View — Lake Road Station
Cleveland Dept. of Light & Power
Peter Loftus
Consulting Engineer

Bartlett-Snow coal handling at Cleveland

● The view above shows the new Lake Road Station and the older East 53rd Street Plant which receives coal by rail for both plants. All the coal handling equipment for the new plant, including the 380 ft. conveyor that carries incoming coal under the 6 lane boulevard, the reclaiming belt conveyor, gallery, the distributing conveyors, and tripper, were fabricated in our shops and installed by our erectors fully to the engineering specifications. For maximum satisfaction, and fixed unit responsibility, let Bartlett-Snow work with you on your next job.

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Carrying Coal Reclaimed from Storage

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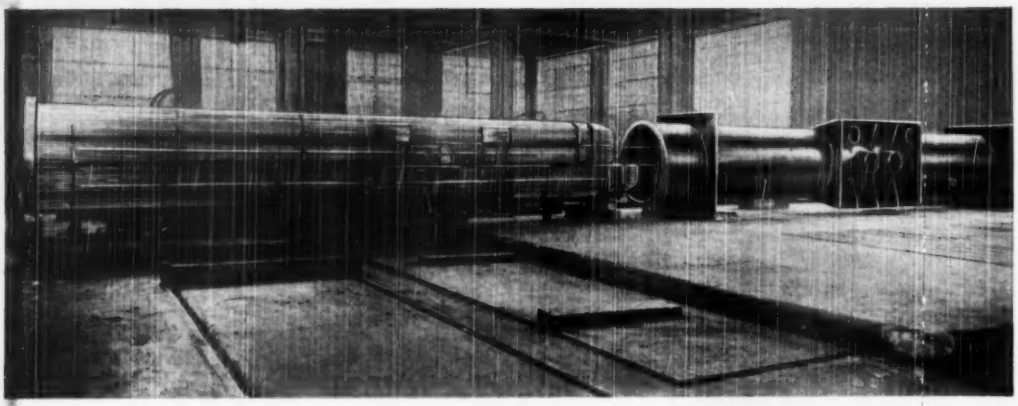
3-in-1 design

SLASHES FEED WATER HEATER COSTS AND SAVES PLANT SPACE



In designing and fabricating this three-stage feed water heater for a northeastern power corporation, Lummus employed an entirely new design technique. All three tube bundles are incorporated within a single shell, and, to effect further savings, the shell is bayonetted into the steam dome of the condenser.

This 28-foot feed water heater has a combined effective surface area of 4680 square feet. Each tube bundle is an individual unit separated in the shell by welded-in baffle plates.

Savings made possible by such design ingenuity are considerable. Not only does this compactness result in saving plant space, but such a compact unit costs far less to build . . . costs less to install . . . and is actually more efficient than three individual units.

A typical job? No, but a typical example of the design intelligence and construction skill that go into every Lummus-built job—advantages that are yours when you use Lummus for your heat exchanger requirements.

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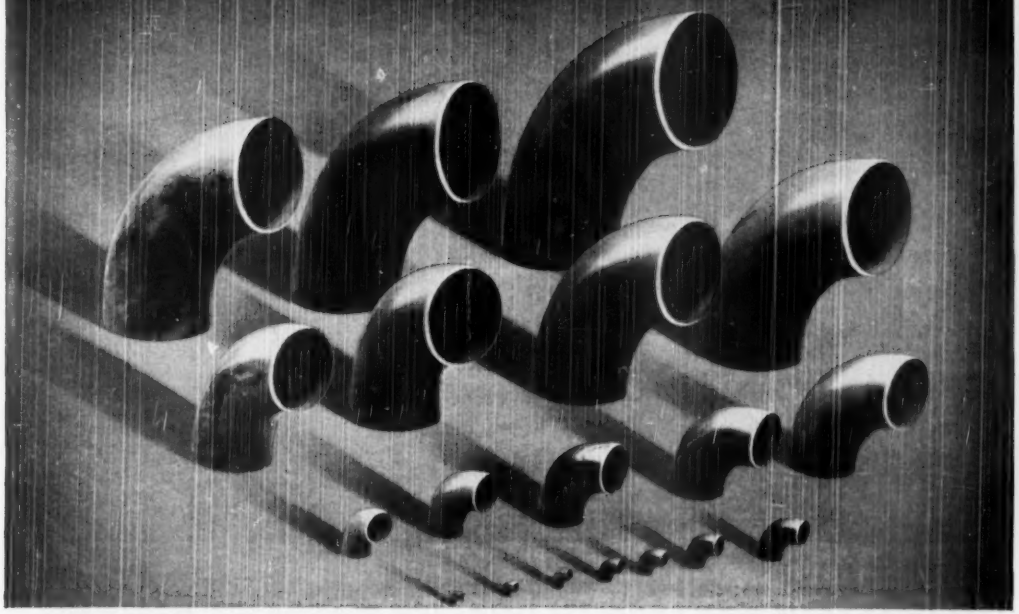
WeldELLS



Family Group ... *proud of its size ... and traditions*

Large group though it is, you see here only one branch of the world's largest family of fittings for pipe welding.

It is simply the stock sizes of long-radius WeldELLS in a single weight and material — merely a small fraction of the enormous line that includes more types of fittings, in more materials, more weights and more sizes than any other line.

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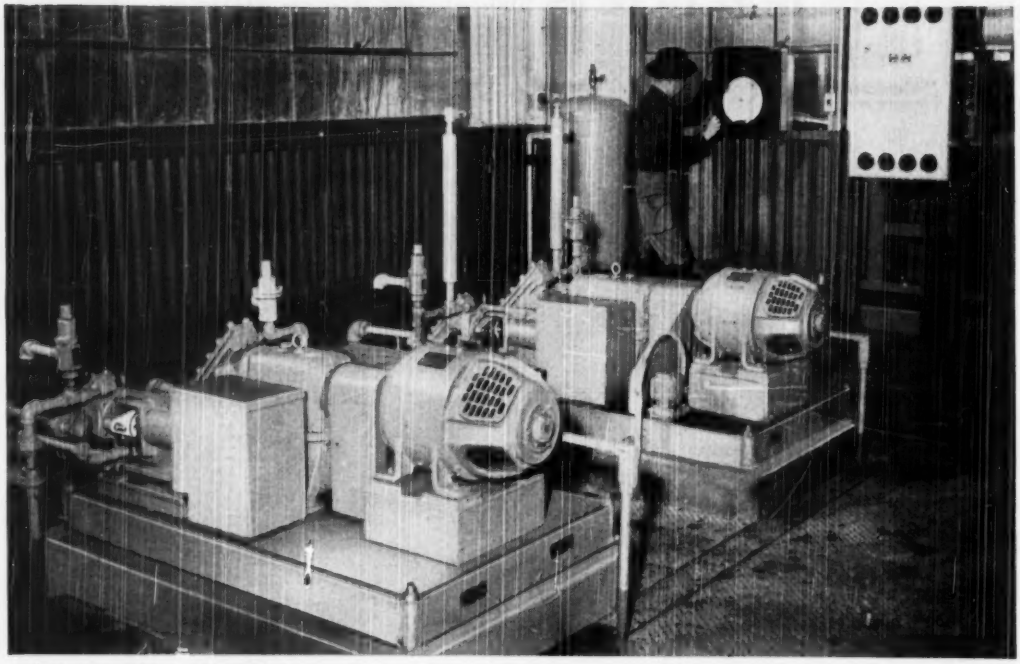

Photo Courtesy Fibreboard Products, Inc.

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In its new multi-million dollar San Joaquin Division Kraft mill at East Antioch, California, Fibreboard Products, Inc. installed water pumping and water treating facilities to meet an ultimate demand for 15 million gallons of water daily for mill and steam requirements.

Water is pumped from the San Joaquin River. In the pump building on the river bank duplicate Milton Roy Duplex Pumps are installed. One side of each Duplex unit handles a maximum of 690 gph Baylis-Sol solution (activated sodium silicate). The other side handles alum solution at a maximum of 156 gph. One pump is a standby unit, to guarantee uninterrupted service. All other controlled volume pumps in the mill are Milton Roy units.

These Milton Roy Pumps are fully automatic in operation, with Thymotrol control, including an electronic flow meter and flow responsive controller, to record flow of water and integrate the chemical treatments.

Milton Roy custom engineers and builds chemical feed systems, furnishes accessory and auxiliary equipment as required for such systems, also supplies complete "Packaged" units for boiler water treating requirements, large or small. When you need water treating equipment, from a simple controlled volume chemical pump to an elaborate automatic pH control system, Milton Roy engineers will be pleased to cooperate with you and your consulting engineers.

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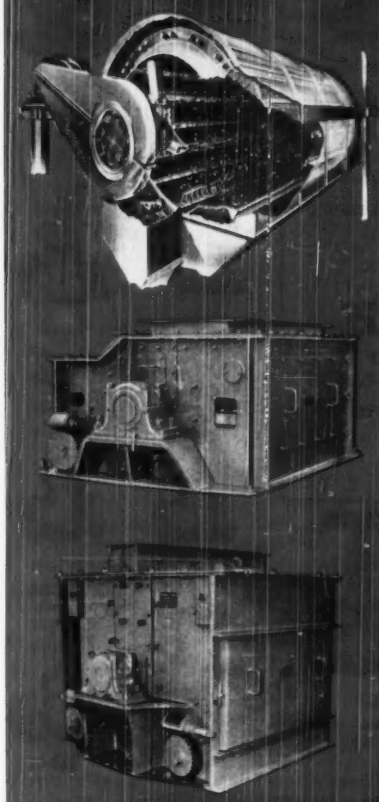

The Pennsylvania line of Crushers is so varied and complete that there is a size and type of crusher for every Power Plant regardless of size or nature of the coals and size product desired.

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For nearly half a century Pennsylvania Bradford Breakers and Bradford Hammermills have been used by power plants as the most economical primary crushers and cleaners for preparing run-of-mine coal to a product suitable for feed to pulverizers and stokers. The dependable scavenging feature assures protection to conveyors, stokers and pulverizers from tramp iron and debris. Send for literature.

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Pennsylvania Reversible Hammermills are giving excellent service in the preparation of coal to meet the exacting specifications for cyclone burner installations. This crusher is made in a special pressurized type for direct firing — standard type for bin system. The reversible feature makes this crusher two crushers in one. Lowers maintenance costs. Send for literature.

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H-W PLASTIC FIRE BRICK Refractories available in Standard and Super Grades are shipped in proper plastic consistency for immediate use. They are easily rammed into place for patching and maintaining settings, as well as for the construction of walls. Made from carefully selected calcined and bond clays of highest quality, H-W Plastic Fire Brick resists destructive spalling and slagging influences.

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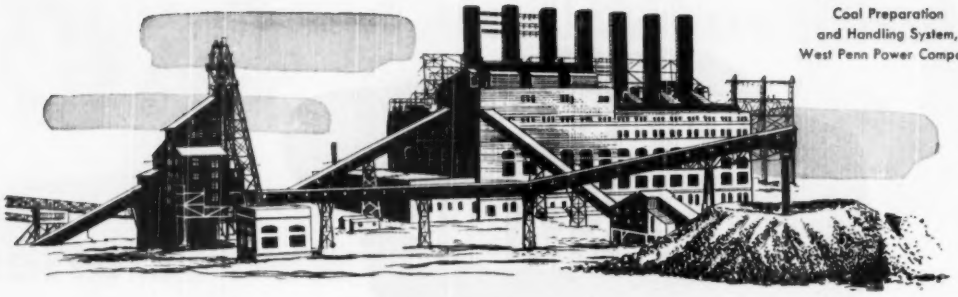

Coal Preparation and Handling System, West Penn Power Company

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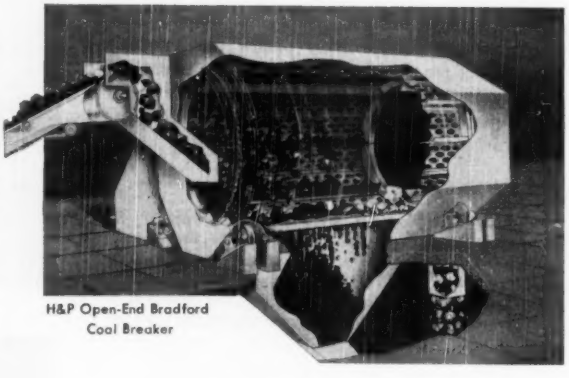

H&P Open-End Bradford Coal Breaker

What makes the **"TURN-KEY"** *way* **TICK?**

Ask a Heyl & Patterson Engineer to consult with you. Let him tell you how the complete job can be handled by Heyl & Patterson all the way from design to erection.

Thorsten Automatic Reciprocating Coal Sampler

For POWER PLANTS

Heyl & Patterson has the engineering knowledge, the experience and the facilities to furnish completely Coal Preparation and Handling Systems for Power Plants.

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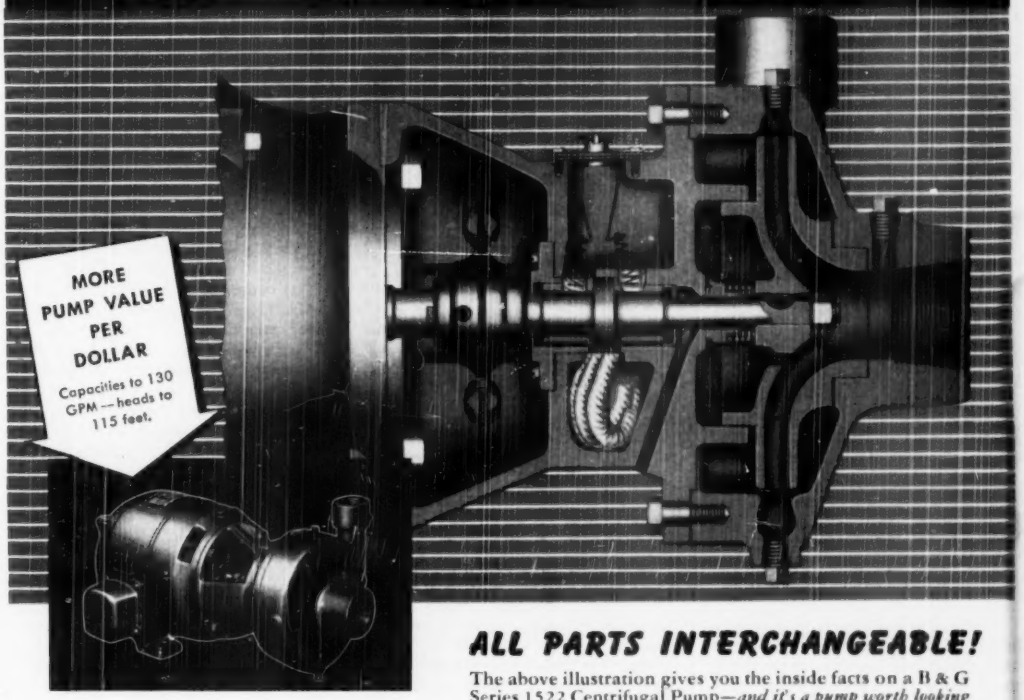
B & G 1522 *Challenges Comparison*

...WHERE ELSE CAN YOU FIND SO MANY PERFORMANCE FEATURES IN ONE PUMP!



B & G Type "SU" Instantaneous Water Heaters

For heating water with steam. Ideal for industrial plants where large volumes of hot water are required continuously for service water supply or process work. No storage tank required—the large heat transfer surface in these units heats water instantly as needed. Available in wide range of capacities.

ALL PARTS INTERCHANGEABLE!

The above illustration gives you the inside facts on a B & G Series 1522 Centrifugal Pump—*and it's a pump worth looking into!*

Viewing from left to right, note the *exclusive* spring-type Coupler—keeps noise at a minimum. Next, the Shaft—polished special alloy steel of finest quality, with electronically hardened thrust collar. It rotates in long Bronze Bearings which assure alignment and smooth operation. Oil from the reservoir is brought to the bearings by the wicking—keeps them thoroughly lubricated.

Now the Mechanical Seal—self lubricating—positively excludes water—ends annoying leakage. And finally, the Impeller—hydraulically balanced and highly efficient throughout the entire capacity range.

All parts are interchangeable in B & G Series 1522 Pumps. By removing a few bolts, the pump separates into three parts—very easy to service if ever necessary.

The B & G 1522 is really a pump you can lean on! For complete information, send for Catalog CY-350.

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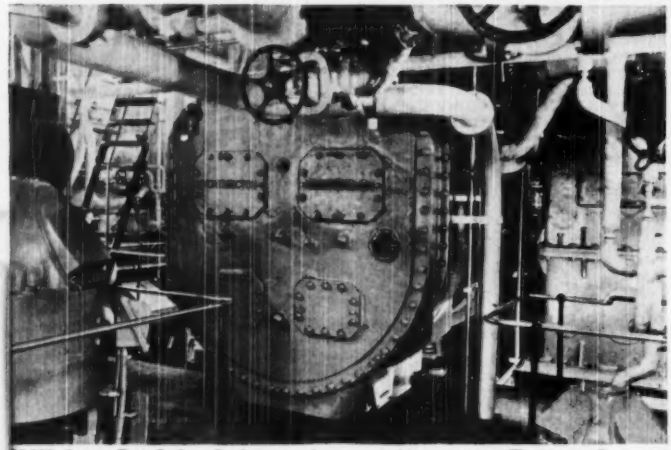
MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*



78,000 Square Feet Surface Condenser used on cargo ship . . . courtesy Worthington Pump and Machinery Corporation, Harrison, New Jersey.

Cupro Nickel Condenser Tubes Outstanding in Marine Service

Which alloy will give the best service in marine condensers? Prolonged tests under various operating conditions, made by the U. S. Navy some years ago, indicated that cupro nickel was far superior to Admiralty and generally better than aluminum brass. For this reason the Navy has, for a number of years, standardized on 70-30 cupro nickel for warships and even for other types of vessels over which it has jurisdiction.

During the war period many ships were built and were equipped with 70-30 cupro nickel condenser tubing. Examination of some of these ships show the tubes to be in fine condition even after being in operation for about ten years.

One large passenger ship built in 1940, which carried troops during the war and has been in passenger service for the past four years, has had wonderfully satisfactory service with 70-30 cupro nickel. Only a very few tubes have been plugged in the 10 years of operation. Examination of the water boxes, tube sheets and tube ends indicates that general conditions are still good.

The tubes, ¾" OD and 18 BWG gauge, are cleaned on the average of once each month. Relatively little trash finds its way into the condenser tubes themselves. When the vessel was recently in coastal areas, a school of herrings ended up in the water box which made it necessary to clean out the water boxes and condenser tubes.

Vertical impeller type pumps are used to supply circulating cooling water to the main condensers when operating at less than 10 knots. When outside harbor waters and above 10 knots, the pumps are cut out and the water is forced in through scoops protruding from the bottom of the vessel.

During cleaning, air is blown through the tubes and water boxes to dry out this area. Special protective paint is applied to the water boxes and tube sheets. When metal surfaces are new, paint adheres quite well but once under-paint corrosion occurs, it becomes more difficult to maintain the continuity of the paint film. Rust forming beneath the film causes the paint to flake off. Blocks of zinc were bolted to the water box surfaces but there was some question as to the amount of good they were doing.

Auxiliary condensers, oil coolers, refrigerating equipment and other heat exchanger units were equipped with 70-30 cupro nickel or aluminum brass tubes. Here more trouble was encountered than in the main condensers.

Examination of numerous other vessels equipped with cupro nickel condenser tubes that have been in service up to ten years also indicate that cupro nickel is giving a good account of itself.

Although Admiralty condenser tube alloy was standard for ship condensers operating in clean ocean waters for many years, the trend has been to more corrosion resisting alloys such as aluminum brass and cupro nickel. It is admitted that present day faster speeds and higher water velocities are too severe for Admiralty, which is subject to premature failure from impingement attack.

Cupro nickel often does not give a satisfactory performance in harbor waters that are brackish and polluted with wastes from cities and factories. Here aluminum brass and aluminum bronze should be tried out.

Effect of Iron Content

In recent years, iron has been added to the 70-30 cupro nickel alloy because it is beneficial in resisting impingement corrosion from clean circulating sea water.

The navy specifies iron content of 0.25-0.60% for both condenser and other types of cupro nickel tubes. When certain types of pollution contaminate the sea water, iron is not effective in retarding impingement. Cupro nickel condenser tubing is widely used in feed water heaters because it withstands the effects of higher temperatures better than the brasses.

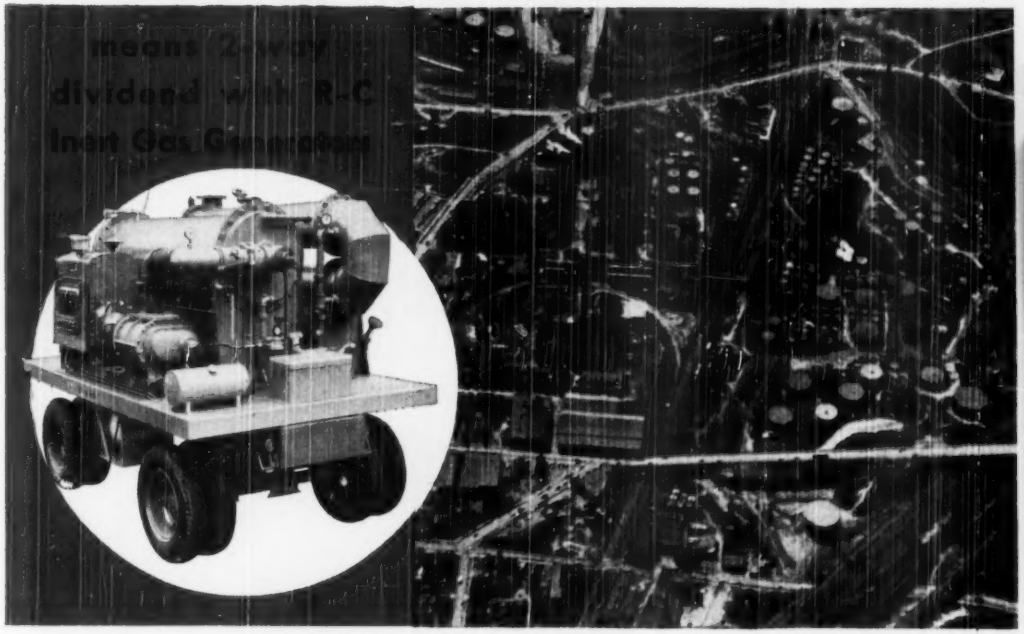
BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

FIRE PREVENTION

plus INSURANCE SAVINGS



Savings in insurance premiums of $6,000.00 per month, and reduction of 500 different policies to three, were obtained by one extraction processor, due to the elimination of fire and explosion hazards in his three plants, essentially aided by R-C Inert Gas Generators.

Admitting that this instance is exceptional because of the size of the plants, the amount of insurance, and other factors, nevertheless it is apparent that both large and small companies may make important savings in insurance costs, and provide improved protection against business interruption and property damage, where explosion and fire hazards must exist in their processing.

Through the use of inert gas, economically generated by R-C units, hazardous plant locations can be made safer against explosion and fire, thus proving again that "an ounce of prevention is worth a pound of cure". Portable units are readily movable from one plant to another, or stationary units can be installed where such hazardous conditions must be continuously contended with.

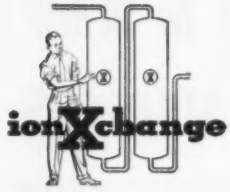
Roots-Connersville has made many successful installations. Ask us to send you Bulletin 100-B-14. There is no obligation.

ROOTS-CONNERSVILLE BLOWER CORPORATION
512 Powell Avenue • Connersville, Indiana

ROOTS-CONNERSVILLE

ONE OF THE DRESSER INDUSTRIES

BLOW-DOWN CUT 100,000 GALLONS PER DAY AT CATERPILLAR TRACTOR CO.



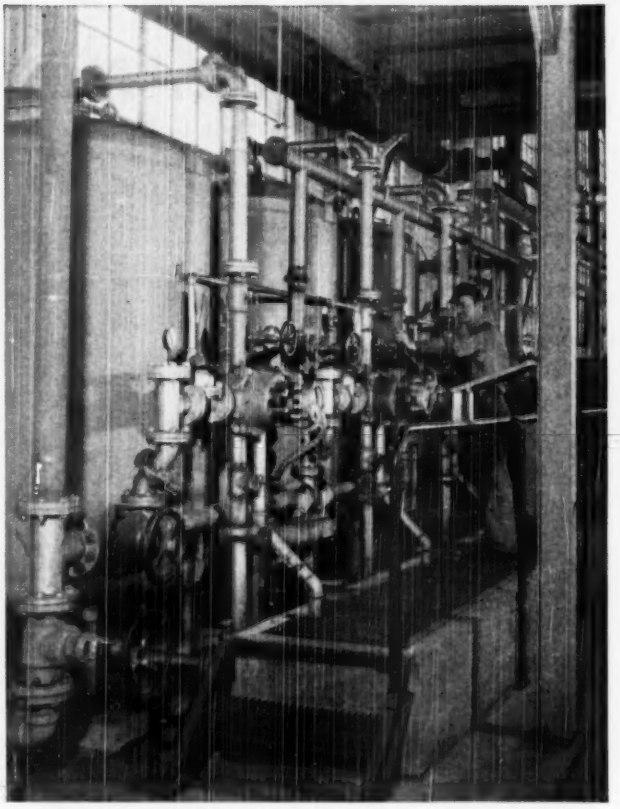
ILLCO-WAY's simplified modern boiler water conditioning system cuts steam costs, boosts efficiency at Caterpillar Tractor Co. plant

"Caterpillar" operates twelve 630 H. P. boilers on de-alkalized water. The boilers can be operated at 200% capacity, or at 1260 H. P.

Use of ILLCO-WAY equipment, shown at right, has reduced blow-downs by approximately one-half of former requirements. Continued use of de-alkalized water is expected to produce even greater blow-down reduction in the future.

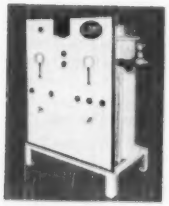
In nine months of operation the savings on make-up water have been very pronounced, Caterpillar reports. During normal operations, an estimated 100,000 gallons per day on make-up water are saved by using ILLCO-WAY equipment, as the result of elimination of excessive blow-down.

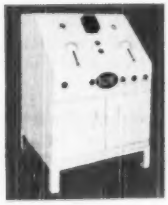
ILLCO-WAY De-alkalizing equipment produces water suitably low in alkalinity, reduced in solids content, and free of hardness, at a cost comparable to softening. Write for literature today.



ILLCO-WAY De-alkalizing installation in power plant at Caterpillar Tractor Co., Peoria, Illinois

De-ionizers for plants & labs. requiring up to 150 gph of chemically pure (solids-free) water





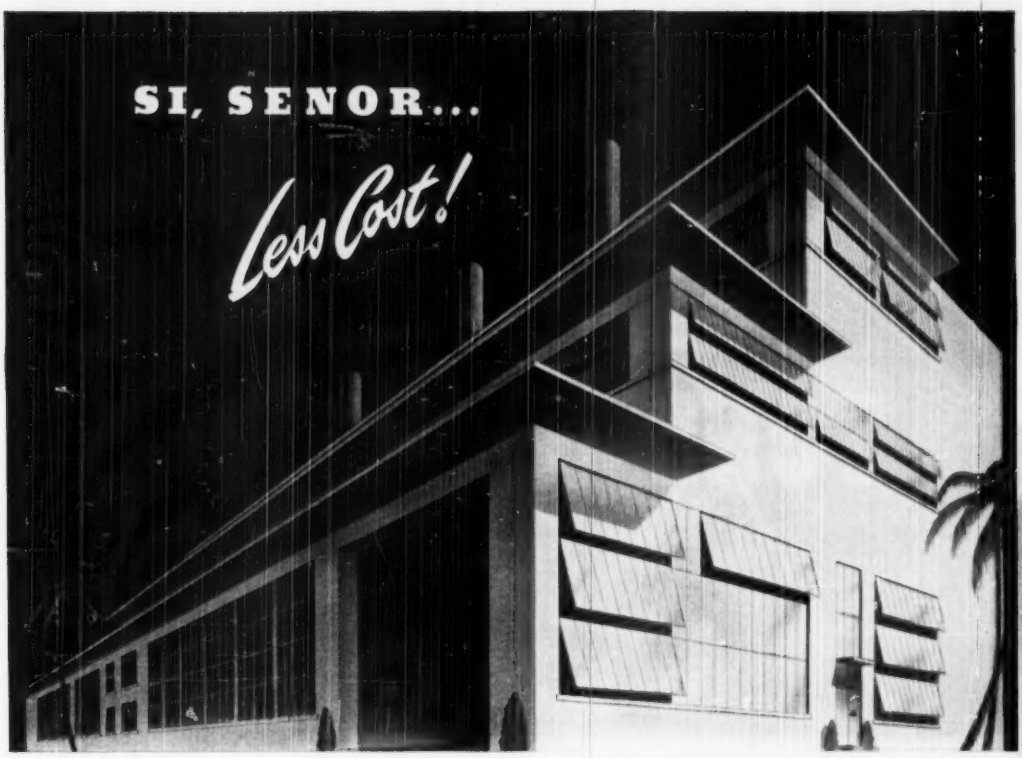
Model LU-100 (left) is furnished with operating panel. Model LU-100-D (right) is enclosed in attractive steel cabinet. Units are equipped with semi-automatic single control multiport valves for simplicity of operation.

Same high quality of water is produced by these popular LU series De-ionizers (shown at left) as by the larger ILLCO-WAY industrial installations. Equipment is shipped assembled, requires a minimum amount of work to install. Connection is to existing water and drain lines . . . New ILLCO-WAY by-pass system assures highest quality water throughout complete service cycle...Because the most efficient type of exchange materials are employed, operation costs only a few cents per thousand gallons of water treated. Write for chart and data.

ILLCO-WAY

DE-IONIZING
DE-ALKALIZING
SOFTENING

ILLINOIS WATER TREATMENT CO., 853-12 Cedar St., Rockford, Illinois • 7310-NN12 Empire State Bldg., New York



Designed and built in South America by The Kuljian Corporation

NO MATTER where it is built—in the high latitudes or down in the tropics—a power plant or industrial power installation under the Kuljian System costs less.

This is due to savings gained by advantageous buying of materials, to the long experience and intensive training of engineers, and to the mechanical proficiency of construction teams *plus the Kuljian System.*

The Kuljian System is available three ways:

PLAN 1 covers designing of the new plant including engineering supervision of construction.

PLAN 2 covers construction only, working from plans prepared by your own or other engineers.

PLAN 3 covers complete services—designing, engineering and construction—carrying the project from inception to initial operation.

Why not call Kuljian when ready to discuss your plans for the future?

KULJIAN

ST. PETERSBURG, FLA.
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MEXICO CITY, MEXICO

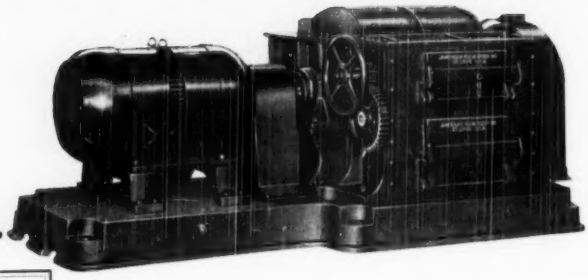
The Kuljian Corporation

ENGINEERS • CONSTRUCTORS

1200 NORTH BROAD STREET, PHILADELPHIA 21, PA.

Decisive Evidence of the Built-In Quality of

AMERICAN CRUSHERS



A Report From 29 Coal Mines and Power Plants:

These significant facts are the result of a recent independent survey in which American Crusher users gave their reports—based on 61,161,372 tons of crushed coal:

(1) Total cost of operation of American Crushers was *less than 1¢ per ton.*

(2) Average parts replacement cost was $.0012 per ton (including cost of standby parts not yet used).

(3) Average age of American Crushers at time of survey—9.35 years.

Conclusive proof that Americans are "built to take it"—built to produce year after year, ton after ton.

Write for your copy of the "AC Coal Crushing Bulletin."

American PULVERIZER COMPANY

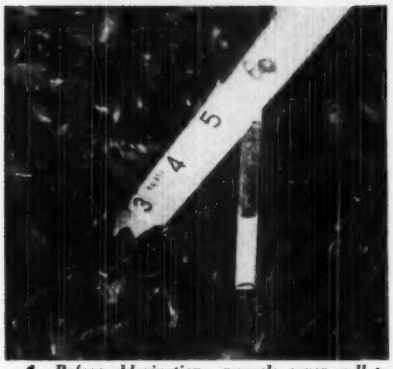
Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE. ST. LOUIS 10, MO.

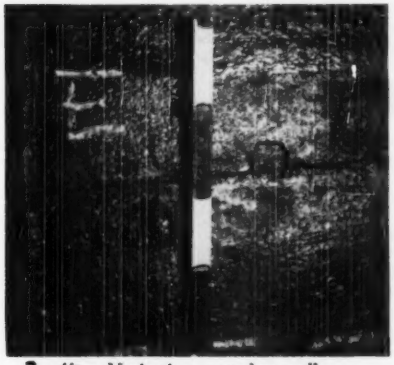
CHLORINATION BY WALLACE & TIERNAN

CONTROLS MARINE FOULING AT GENERATING STATION

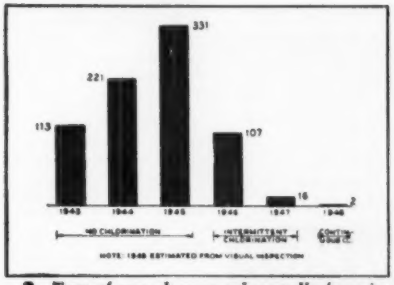
LOOK AT THESE RESULTS



1. Before chlorination — mussels cover wall to depth of 3".



2. After chlorination — note bare wall.



3. Tons of mussels removed annually from intake tunnel of generating station.

It all began when a New England generating station sent down a diver for a routine inspection of the large, concrete, circulating-water, intake tunnel located approximately 13 feet below the harbor's surface. The diver discovered this intake was lined with unusually heavy growths of common mussel (Mytilus), sea moss (Tubularia), and sea anemone (Metridia).

These were expensive visitors. First, mussel accumulation created poor vacuum as the mussels lodged in condenser tubes and aggravated slime and silt formation. Then, as the mass increased in quantity, it became necessary to clean the intake tunnel every year to remove up to a maximum of 331 tons of mussels — a time consuming process that cost thousands of dollars in labor and equipment outage.

To combat these conditions a long and thorough study was made of marine fouling. As a result it was decided to use intermittent chlorination applied by Wallace & Tiernan Chlorinators. First to fall under this attack were the sea moss and the sea anemone. The tougher mussels however, still remained as numerous as ever.

In an all out effort to get rid of these trouble makers, continuous chlorination at heavier residuals was started. This treatment turned the trick and the mussels were reduced to such a low level that yearly cleaning has not been required.

These results saved the New England company thousands of dollars annually by eliminating intake tunnel cleaning, reducing condenser outages, and producing a higher vacuum with a resultant saving in fuel.

Perhaps your problem is one of slime or fouling due to some other marine organism. In any event, if biological fouling is costing you money through lowered cooling water efficiency it's a safe bet that chlorination can help.

See your nearest Wallace & Tiernan Representative now for all the details.

CD-34

WALLACE & TIERNAN PRODUCTS, INC.

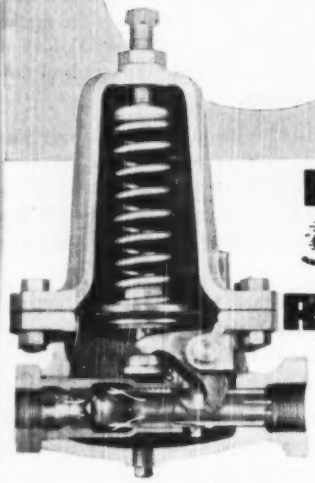
CHLORINE AND CHEMICAL CONTROL EQUIPMENT

Belleville 9, New Jersey • Represented in Principal Cities

EXTRA LARGE CAPACITY
TIGHT CLOSING CHARACTERISTICS
CLOSE DELIVERY PRESSURE CONTROL
WIDE RANGE OF ADJUSTMENT

Combine to Give You..

SMOOTH OPERATION
SPEEDIER PRODUCTION
NO SPOILAGE



CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES

The "1000" valve is single seated and its valve makes line contact with its seat ring which accounts for its tight closing characteristics. The unusually long diaphragm spring insures sensitive pressure control.

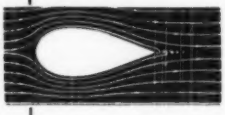
Steam, water, air, oil, etc. flow through this valve in a straight line—nothing is in the path of flow to cause turbulence — therefore, peak flow is never a problem.

TURBULENCE LIKE THIS *Eliminated*

The inner valve is streamlined — no back eddies to hinder flow — valuable when you want all possible fluid to go through the valve to meet peak demand.

Turbulence eliminated by venturi approach to the valve seat — it means better flow. The inlet pressure is confined to a small cylindrical chamber, the same being advantageous for high pressures.

YOU GET THIS *Streamlined* PATTERN

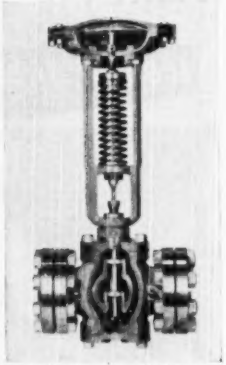


Write for bulletin "1000" that fully explains the cost-saving benefits that begin with installation and last for years.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

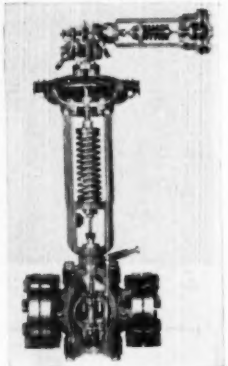
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 34 Pressure Reducing Valve. For practically all fluids. Has roller bearing, also roller guides that kill side strains and stop packing trouble —no lost motion.

Sizes: ½" to 12" inclusive. Highest initial pressure 800 lbs.; reduced pressure vacuum to 150 lbs. Bodies: iron, bronze, steel. Trim: iron, bronze, stainless steel. Ends: screwed, flanged, ammonia type, welding type. Bulletin 968.

☆

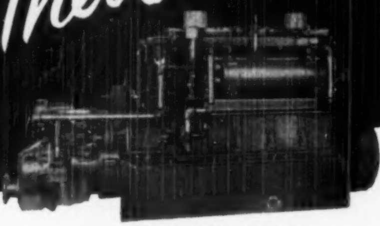


Cash Standard Type 30-AP Valve gives precise control of fluid pressures, through a pilot connected to the pressure under control. For steam, water, air, and most fluids.

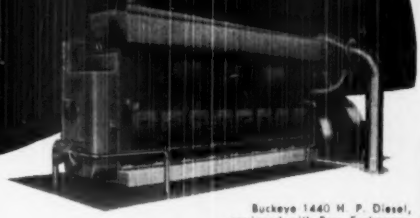
Can be a pressure reducing valve or a back pressure valve depending on the way the control lines are connected. Pressures up to 600 lbs. Sizes ½" to 12" screwed; 1" to 12" flanged ends; wide variety of metals.

☆

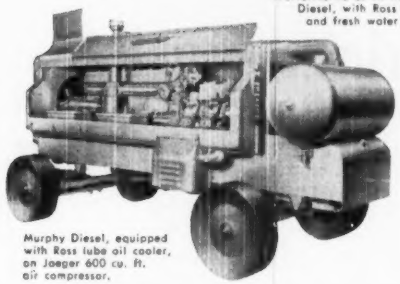
Their Choice because their reputations are at stake



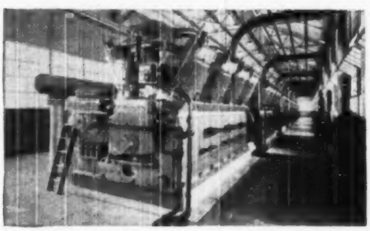
Wolverine 40 B. H. P. Marine Diesel, with Ross lube oil and fresh water coolers.



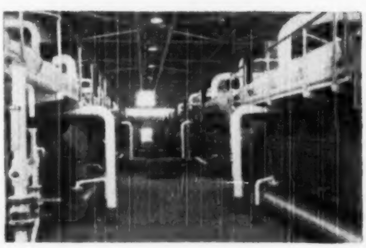
Buckeye 1440 H. P. Diesel, equipped with Ross Exchanger, in municipal light plant.



Murphy Diesel, equipped with Ross lube oil cooler, on Jaeger 600 cu. ft. air compressor.



Nine Cooper-Bessemer gas compressors, equipped with Ross lube oil coolers, serving natural gas pipe line.



One of 14 Ingersoll-Rand 1000 H. P. gas compressors, equipped with Ross lube oil coolers, serving natural gas pipe line.

Don't Miss This!
HEAT EXCHANGER EDUCATIONAL EXHIBIT
Sponsored by A.S.M.E. and T.E.M.A.
NATIONAL POWER SHOW
Nov. 27 - Dec. 2, New York City

Engineering, uncompromising in its thoroughness, workmanship carried out with utmost care and precision . . . these are the prime elements that go into the making of a Diesel today . . . the prime elements that enable it to be the efficient work horse that it is.

But the thoroughness, care and precision that gain a higher reputation for one maker over another, can not and *do not* stop with the components that are manufactured in his own plant. Outside-made components and accessories must, *necessarily*, measure up to the same standards.

And so it is that such leaders as Wolverine, Buckeye, Murphy, Ingersoll-Rand, Cooper-Bessemer (to name a few), whose engines are shown here, are insistent that their exchangers conform wholly with rigid standards. That they have used Ross for many, many years, is a natural choice. Over 81% of the Diesel engine builders do the same.

For, maintaining safe and effective lube oil and jacket water temperatures are jobs that Ross Shell and Tube Exchangers have a reputation for doing well . . . and to put it in Wolverine's words, "It's things like these that helped build Wolverine's reputation for long-life, low-maintenance Diesels."

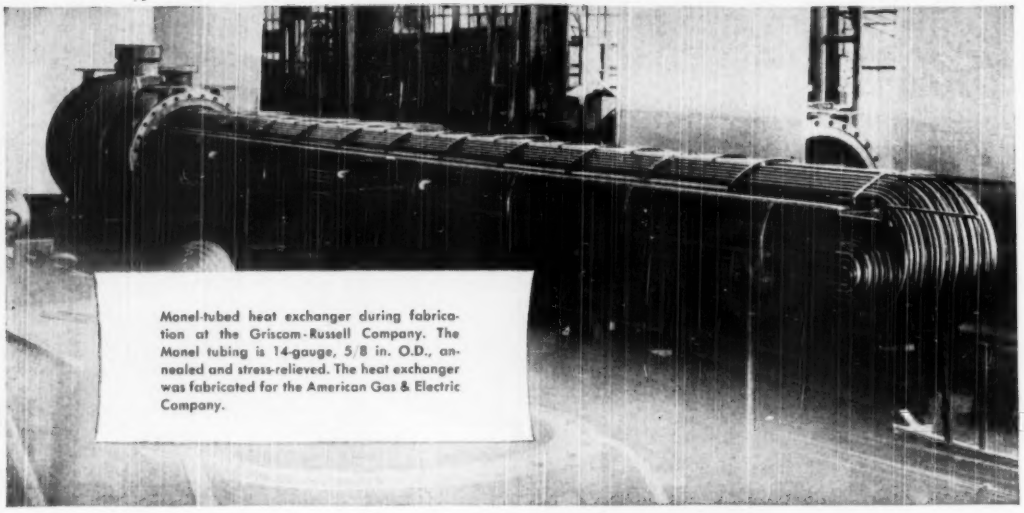
★ **Design Data** . . . and complete details on Ross cost-saving standardization: BULLETIN 1.1K1, all copper and copper alloy, fixed tube sheet Type BCF; BULLETIN 1.7K1, all stainless steel, fixed tube sheet Type SSCF; BULLETIN 2.1K1, cast iron or steel shell, removable bundle Type CP; BULLETIN 2.2K1, all copper and copper alloy, removable bundle Type BCP.

Write on Company letterhead to Ross Heater & Mfg. Co., Inc., Division of American Radiator and Standard Sanitary Corp., 1415 West Ave., Buffalo 13, N. Y. In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

ROSS
EXCHANGERS

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ... • KEWANEE BOILER • ... • TONAWANDA IRON



Monel-tubed heat exchanger during fabrication at the Griscom-Russell Company. The Monel tubing is 14-gauge, 5/8 in. O.D., annealed and stress-relieved. The heat exchanger was fabricated for the American Gas & Electric Company.

Higher pressures obtained with *stress-relieved* Monel tubing

Cold drawn, stress-relieved tubing has significantly higher mechanical properties than annealed tubing of the same composition.

This important engineering fact is acknowledged in the A.S.M.E. Boiler Code which now allows the use of stress-relieved tubing in boiler heater applications.

In practical terms, this means that boiler feedwater heaters can be designed for higher operating pressures and temperatures *without increasing tube wall thicknesses.*

Thinner tube walls, transmitting heat more rapidly, can also result in greater unit efficiency with no increase in overall dimensions.

Cold drawn, stress-relieved *Monel*® tubing offers still other advantages in heater tubing applications. *Monel's* high resistance to corrosion inhibits scale formation. Its superior hardness effectively reduces erosion and cavitation damage. And—an important asset—*Monel* can be welded directly to steel by conventional techniques.

If you are contemplating new tubed feedwater equipment, write to P. F. Sheridan of Inco for engineering information about cold drawn, stress-relieved *Monel* tubing.

EMBLEM OF SERVICE INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

MONEL... *for Minimum Maintenance*

"For high dust collection efficiency CONSIDER THESE FACTS!"

95% to 99% REMOVAL

Your specific needs determine the exact percentage of fly ash removed by a Research Corporation Cottrell Precipitator.

LOW DRAFT LOSS

The pressure drop between inlet and outlet of the Cottrell is extremely low, averaging *only a few tenths of an inch of water.*

DURABILITY

Low velocities hold abrasion to a minimum.

ANY CAPACITY

Cottrell precipitators have been used successfully with both small boilers and the very large boilers developed in recent years.

OTHER APPLICATIONS

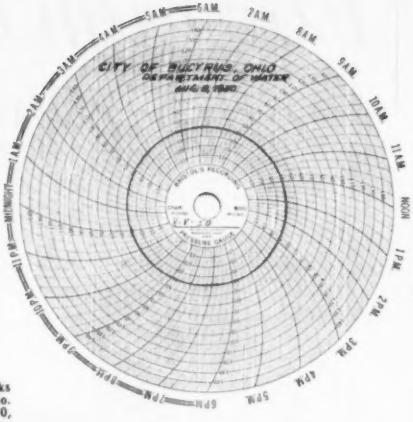
Cottrell precipitators have wide application in the recovery of other materials such as acid mist, blast furnace dust, sodium salts, fluid catalyst and valuable metals from smelters.

YOU GET all these important advantages PLUS Research Corporation's 38 years of experience in the field of electrical precipitation. Every Cottrell installation is individually engineered to do the most efficient job. For more facts about Research-installed Cottrells, send for Bulletin 500.

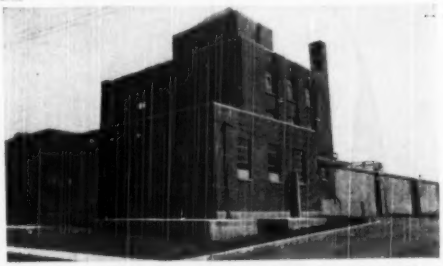
RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

How Bucyrus, Ohio, solved its pressure problem—with Stickle!



(Below). New water works plant, Bucyrus, Ohio. Dedicated, August 30, 1950, by H. W. Section, American Water Works Association.



Installation: New, one-half million dollar water works plant, Bucyrus, Ohio (illustrated below). General Contractor, Richmond Construction Company, Mansfield, O. Consulting engineers, Floyd G. Browne and Associates, Marion, O. Daily capacity, 4,000,000 gallons of water, distributed through 35 miles of cast iron and wooden pipe lines.

Problem: How to assure safe, accurate pressure reduction, from 60 lbs. in cast iron lines to 40 lbs. in 45-lb.-capacity wooden lines serving city's industries.

Solution: Installation of 12" Stickle Remote Pilot Operated Pressure Reducing Valve. Chart, above, recorded during 24-hour period when fire hydrants were flushed all over town, shows how Stickle Valve held water pressure within 1-pound variation — around the clock.

For You: FREE Stickle Bulletin No. 235, picturing valves, listing prices, Write:

Stickle Steam Specialties Company
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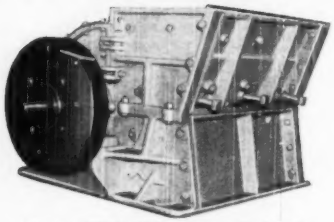
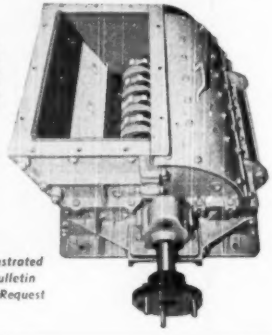


Gruendler XXE 24x48 Ring Hammer Coal Crusher



Coal eye view of XXE showing heavy duty manganese breaker plates and ring hammer rotor coal breaker

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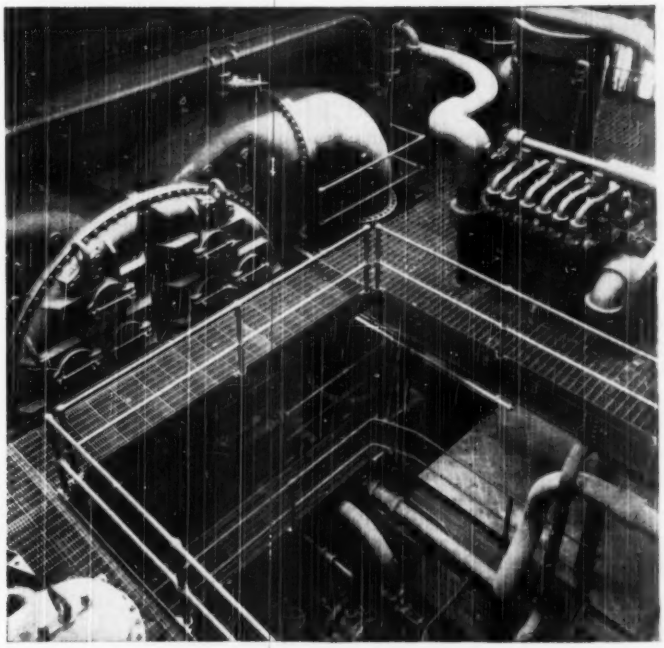

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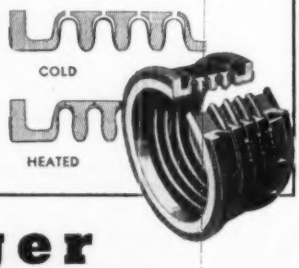

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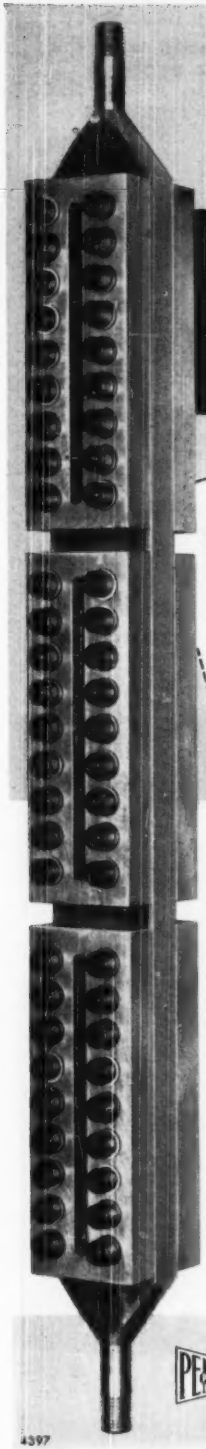

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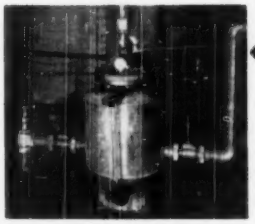

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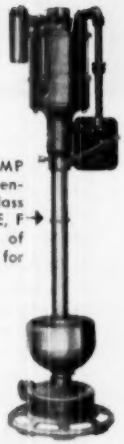

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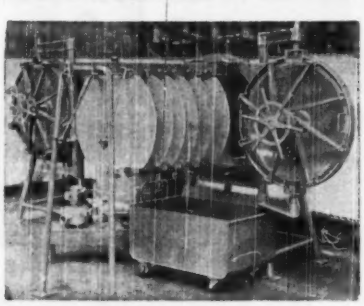

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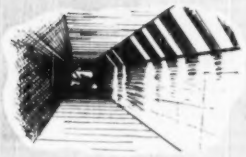

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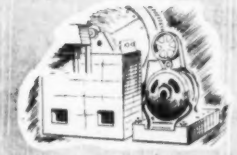

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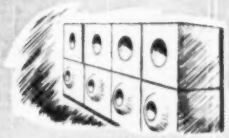

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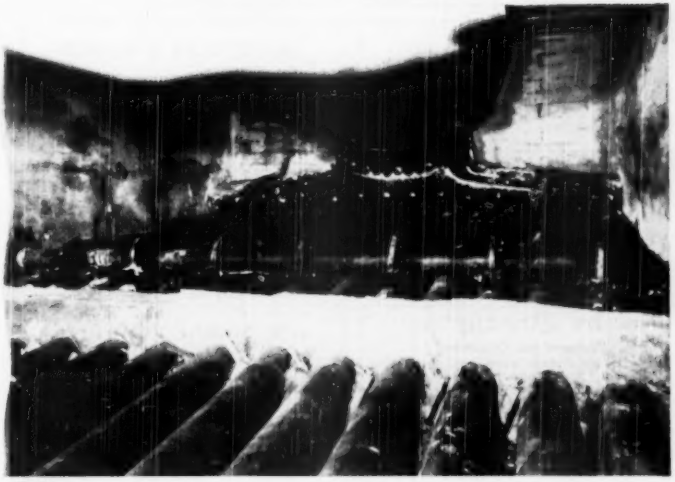

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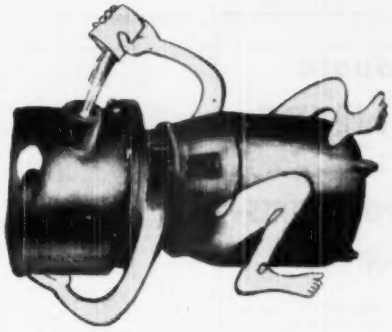

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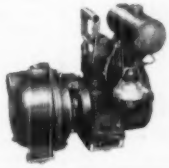

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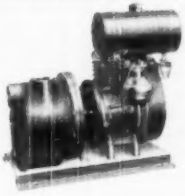

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POSITIONS VACANT

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WANTED CONTROL VALVE Designer—preferably young graduate engineer with some related experience. Exceptional opportunity to grow with progressive, nationally known company. P-7940, Power.

SALES ENGINEERS, with experience in the sale of mechanical equipment, wanted for positions as sales engineers for mechanical draft and air handling apparatus. Positions are available at various locations. Personal interviews will be granted only after receipt of written application giving full details of experience. Address: Sturtevant Division, Westinghouse Electric Corporation, Dept. AH, Hyde Park 36, Boston, Massachusetts.

CONTRACTING ENGINEERS want Designer-Estimator for installations of industrial boilers and accessories, oil burners and stokers, piping, heating, and controls. Drafting and supervisory experience required. Mechanical degree desirable. Eastern Pennsylvania applicants only submit details and salary. P-8203, Power.

ENGINEER WANTED by Meat Packing Plant in southern Ohio city to take full charge of Power Plant operations and general maintenance. Top salary to fully qualified man. Requirements, Engineering degree with minimum of 5 years successful experience in full charge of boiler plant, electric generation and refrigerating equipment. Replies confidential, give full experience record, detailing duties, responsibilities and size of plant, references, and present and expected salary. Personal photograph helpful. P-8220, Power.

(Continued on page 332)

ATOMIC POWER

WESTINGHOUSE ELECTRIC CORPORATION

IMMEDIATE OPENINGS

For experienced senior and junior engineers

- Servomechanism designer experienced in gear trains, bearing applications, differentials, etc.
- Mechanical engineer, materials experience in wear, corrosion, etc.
- Application or design engineer experienced on hydraulics (pumps, hydraulic motors, flow, calculations).
- Process control engineer, capable of making system study of hydraulic circuits, valves, etc.
- Engineer, experienced in aircraft hydraulic control, remote indication, etc.
- Mechanical designers of complete systems in the instrument servo range.
- Process control engineer to design complete servosystems involving all auxiliary apparatus and all controls.

For application write

Mgr., TECHNICAL EMPLOYMENT
306 Fourth Ave., Pittsburgh 30, Pa.

POWER PLANT PERSONNEL

An east coast utility now constructing a new high-pressure pulverized fuel generating station will accept applications for employment from qualified persons for the following positions.

CHEMIST

To assume full charge of laboratory. Must be experienced and thoroughly conversant with the analysis of water, fuel and lubricating oils. Must know water softening and conditioning and be able to interpret test results into instructions to operators for correction of unusual conditions.

CONTROL ROOM OPERATORS

Will be required to assist the Chief Operator in directing the operation of, and operating from the centralized control room all equipment such as pulverized fuel boilers, hydrogen-cooled turbine generators, switchboards, condensers, boiler feed pumps and all related auxiliaries.

INSTRUMENT MECHANIC

Previous experience on power plant instrument work essential. Must have a good working knowledge of and be able to service and repair such equipment as automatic combustion controls, flow meters, temperature recorders, gages, pH controllers and boiler meters. Must have a good understanding of electrical circuits as well as mechanical devices.

AUXILIARY EQUIPMENT OPERATORS

Must have previous operating experience and be thoroughly familiar with the correct handling of large power plant auxiliary equipment, such as condensers, vacuum pumps, boiler feed pumps, lubricating oil systems, ash systems, air compressors, water softeners, cooling systems, coal pulverizers and associated equipment.

Job is centrally located near excellent residential community, good working conditions, forty-hour week (paid vacations, insurance, sick pay and retirement plan). All personnel selected for employment will be given complete job training at full pay to familiarize them with this particular installation before assuming their regular duties.

Include complete resume of experience and qualifications in first letter, together with recent photograph. Applications treated confidentially when desired.

P-6897, POWER

330 W. 42nd St., New York 18, N. Y.

STEAM PLANT SUPERINTENDENT

Private electric utility building its first steam plant. Need a Mechanical Engineer with steam plant operating experience to act as resident engineer during construction, and then take charge of the operation of 60,000 KW plant. In reply furnish details on experience and qualifications, age, salary required, etc. **Personnel Office, California Electric Power Company, P.O. Box 512, Riverside, California.**

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DECEMBER 1950

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WESTERN UNION

W. P. MARSHALL, PRESIDENT

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...following message, subject to the terms on back hereof, which are hereby agreed to

L.J. LAND, INC.
156 GRAND STREET
NEW YORK 13 N.Y.

INTERESTED IN GETTING FASTEST DELIVERY DATES AND LOWEST PRICES
ON FOLLOWING ELECTRICAL EQUIPMENT (LIST HERE MOTORS, GENERATORS,
COMPRESSORS, TRANSFORMERS, STARTERS, ETC.) UNDERSTAND ALL
REBUILT EQUIPMENT GUARANTEED ONE YEAR.

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ALL LAND REBUILTS

GUARANTEED ONE YEAR

VISIT US WHEN YOU ARE IN NEW YORK

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with RELIABLY REBUILT ELECTRICAL EQUIPMENT

PARTIAL LISTING ONLY FROM ONE OF AMERICA'S LARGEST STOCKS

SQUIRREL CAGE MOTORS

3 phase

H.P.	Make	Type	Speed
200	G.E.	KT557	1760
200	G.E.	KF-6335	880
150	West.	CS	580
100	Wagner	XP	1150
100	G.E.	K-544	1175
100	West.	CS	870
100	Al. Ch.		580
75	West.	CS	1750
75	G.E. (3)	K-505	1175
75	G.E.	IK	900
75	G.E. (3)	KT-352	865
75	West.	CS	720
75	G.E.	KT 558	580
60	F-M	XP	1750
60	Howell	SCR	1800
60	Century		1150
60	West. (2)	CS-607	880
60	Rel. (2)	AA	875
60	G.E.	KT-346	865
60	G.E.	TEFC(GH)	427
50	G.E.	FTR-528	3600
50	Elliott	196	3450
50	West.	CS	1740
50	L. A.	XP	1150
50	West.	XP	1150
50	G.E.	KF-445	1170
50	West.	CS-642C	1160
50	West. (3)	CS	870
50	G.E. (2)	IK	870
50	G.E.	FTR-542	870
50	West.	CS	690
40	G.E.	TEFC(GH)	561

SLIPRING MOTORS

3 phase

H.P.	Make	Type	Speed
600	Cr. Wh.	121AQ	507
500	G. E. (2)	IM	450
400	West.	CW1218	500
225	Wagner	25 cy.	710
200	G.E.	MTP-557	1800
200	G.E. (2)	IM	1170
150	Wagner	31VRN	900
100	Al. Ch.		690
75	West.	CW	1150
75	G.E.	IM	690

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
475	West.		720
400	G.E. (2)	TS-928 S	600
300	G.E.	ATI	900
260	G.E.	TS	900
250	Ideal	SMN	360
200	Ideal	SMW	257
180	G.E.	ATI	900
150	G.E. (2)	TS	1200
135	West.	G	1200
135	Ideal		1200
100	Elec. Prods.		1200
55	El. Machry.	BRKT	1200

550 V.D.C. MOTORS

H.P.	Make	Type	Speed
765	GE(4)	MPC	1045/1350

230 V.D.C. MOTORS

H.P.	Make	Type	Speed
400	A-C		415
150	G.E.	MPC	400
125	G.E.	RC-15	1750
100	Al. Ch.		1150
90/45	G.E.	RF-17	950/475
75	Sprague		1000/1500
75	West.(2)	180-SK	475
75	Cr. Wh.	LT	480/670
75	Cr. Wh.	CMC	375/950
75	E-D	25S	450/1350
75	West. (3)	SK151	250/1000
60	West. (3)	SK-160	680
50	Diehl		850/1050
45/90	G.E. (2)	RF-17	475/1950
50	West. (3)	SK-160	565
50	G.E.	RF-17	250/1000
50	West.	SK	250/1000

AC GENERATORS

Driven by DC Motors

KVA	Make	D.C. Input	A.C. Output
62½	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	El. Machry.	230	440
18	G.E. (3)	230	120/240
10	Burke	115	120
7½	Hertner	115	440
6¼	G.E.	230	240
5	El. Spec.	115	110
1¼	Al. Ch.	230	110

600 V.D.C. GENERATORS

KW	Make	Speed
400	G.E. (4)	1200
325	G.E.	1200
100	West. SK	900
60	G.E.	1200
30	Burke	1750
200	KW, G.E., MPC,	1200 RPM

600 V.D.C. BALANCER

20	Reliance	1150

GENERATORS

250 V.D.C. Motor Driven

KW	Make	Speed
1000	G.E.	900
500	West.	1200
300	Elliott	1200
200	G.E. (3)	720
200	G.E.	1200
150	West.	900
100	Delco	1200
75	G.E.	1200
50	G.E.	1200
40	Rel.	1750
42	ABC(2)	1200
30	G.E.	1200
25	G.E.	1200

125 V.D.C. Motor Driven

KW	Make	Speed
150	West. (2)	1150
100	West. (2)	900
100	G.E.	1200
100	El. Machry.	1200
75	Cr. Wh.	1200
50	Sturt.	2300
50	West. (2)	1150
35	G.E.	1750
35	Ideal	1200
30	G.E.	1150
30	LA	1450
25	El Machry.	1150

TRANSFORMERS

2—400 KVA Maloney Dry Auto—220 to 440 V.

1—300 KVA, Al. Ch. 3 ph 4160 V/230V.

1—300 KVA, Pittsburgh, 3 ph, 4160V/230V. Secondary.

3—150 KVA West. 2300/4100—110/220V.

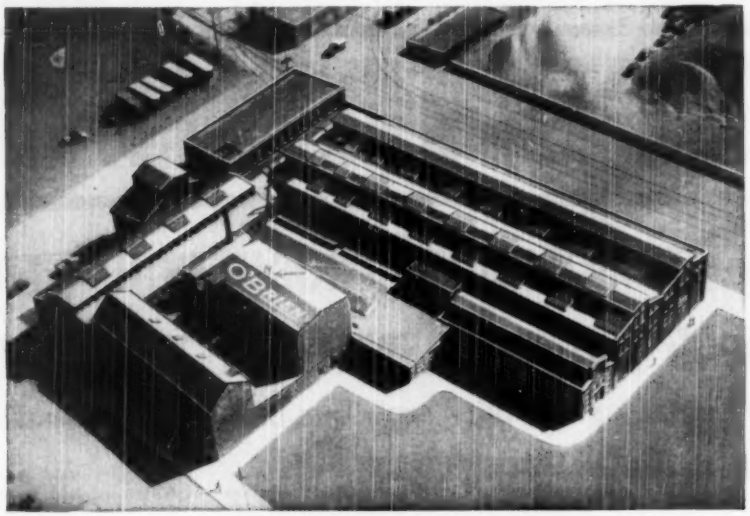
4—25 KVA West. 440/110V.

60—Additional Oil and Insulated Dry-type Transformers in stock, not listed, down to 1 KVA.

L. J. LAND INC.

156 GRAND ST. Canal 6-6976 NEW YORK 13, N.Y.

Q U A L I T Y



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1547 N. DELAWARE AVE., PHILADELPHIA, PA.
PRR Siding—35 ton OEP Crane Capacity

ELECTRIC MOTORS

3 PHASE — 60 CYCLE

Q.	HP	Make	Type	Volts	Speed
1	1200	Cr. Wh.	Sl. Rg.	2300	257
1	1000	West.	CW	2300	450
1	650	G.E.	TS(Syn)	440	360
2	600	West.	Syn.	440	257
1	600	G.E.	IM	440/2300	600
1	400	West.	CW	440	514
1	350	West.	CW	440	600
1	350	G.E.	Syn.	440	900
1	315	G.E.	Syn.	2200	720
1	270	C.W.	C.W.	440	514
1	250	G.E.	K-TEFC	2200	514
1	250	West.	CS	2200 (25 cyc)	375
1	250	West.	CS	2300	1200
2	200	E.M.	Syn.	4160	600
1	200	West.	MW	440	600
1	150	Al. Ch.	SC	220	1800
1	150	Ideal	Syn.	220	1200
1	150	El. Mch.	Syn.	220	900
1	150	G.E.	KT-558	440	900
1	125	Cent.	SC	440	1800
2	100	West.	CS	220	1800
1	100	Cent.	SC	220	1200
2	75	Cent.	SC	440	1200
1	75	West.	CW	440	1200
1	60	Ideal	SC	220	1200
1	60	West.	CW	440	600
1	60	West.	C.W.	440	720
1	50	West.	C.W.	220	900
1	50	G.E.	I.M.	440	600
2	50	Cent.	SC	220	1200
1	40	G.E.	MT-536	440	900
1	30	G.E.	MT-532	440	900
2	25	G.E.	MT-332	440	900
1	100	West.	SK183	230V. D.C.	400/1200
1	50	Cr. Wh.	CMC	230V. D.C.	300/1200

MOTOR GENERATOR SETS

1—1000KW GE MPC ATI 550v. 3/60/2300
1— 750 KW G.E. 250 v. 3/60/2300 volt
1— 500KW GE MPC ATI 250v. 3/60/2300/720
2—400KW ELLIOTT COMPANY, 250 volt, 1200 rpm, 2300 volt, 60 cycle A.C. and D.C. Controls—New 1939
1— 200KW West. 250v. 3/60/2300 volt, 1200 rpm
1— 200KW West. 250v. 3/60/220-440/1200 rpm
1—100KW G.E. 125 3/60/220/1200 rpm Syn
1—80KW G.E., 240 v. 3/60/440/1800 rpm
1— 50KW G.E. 250 volt, 3/60/240/1200 rpm
1— 50KW G.E. 125 volt, 3/60/220/1200 rpm
1— 40KW Ideal, 125 volt, 3/60/220/1200 rpm
1—40KW West. 240 v. 3/60/220-440/1200 rpm synchronous
3—7½KW G.E., 60v. 3/60/220-440 volt

AIR COMPRESSORS

3—12,000 CFM Ingersoll Rand Turbo Compressors 3.25# pressure, 250 HP 3/60/440/3600 rpm motor drive.
1—5000CFM Sullivan Angle Compound 100 psi, 500 HP Syn. M.D. 3/60/2300
1—1050CFM Worthington, 18x11x14 100 psi, 257 RPM, Belted
1—1050CFM Ingersoll-Rand ES-1, 17¾x13, 50 psi, 275 RPM, V-belt
1—734CFM Sullivan Angle Class W13, Single Stage 13x13x8, 60 Lb., 300 RPM, v-belt, 100 HP
2—528 CFM Chicago NSB, 100 Lb., 285 RPM, V-belt, 14x12
2—368CFM Ingersoll ER-1, 285 RPM, 100 psi., 50 HP direct gear, M.D., 3/60/220
1—229CFM NEW Chicago PB 4 Air Cooled, 870 RPM, 125 Lb., V-belted, 50 HP, M.D.
1—245CFM IR-10x10 ER-1, 125 Lb.
1—215CFM Penna. 3A—10x8, 50 Lb.
1—211CFM NEW Chicago 9x9 T-B Horizontal 100 psi, V-belt
2—173CFM Ingersoll ER-1, 9x8, 300 RPM, 100 Lb., V-belt
3—120 CFM I-R—8x6 ER-1, 55 Lb.
1—92CFM I-R—7x6, ER-1, 100 Lb.
1—67CFM Chicago NSB—6x6—150 Lb.

DIESEL GENERATORS

1—2500KVA General Motors, complete plant, 3/60/2300 with 2300 to 230/460 transformers, cooling system, starting equipment, switchboard, can demonstrate on foundations. Immediately available.
1—1000KVA Hamilton Model 99DA, 3/60/2300/600 rpm complete portable or stationary—never used.
200KW Fairbanks Morse, 250 v., D.C. 720 rpm 8 cylinder, 4 cycle, Complete—1940
200KW G.E.-Fairbanks Morse, 720 rpm, 3/60/220/440—8 cyl., 4 cycle—1940
156KVA Cummins L1 400 3/60/440/900 rpm—Radiator—Sw. Bd.
113KVA Waukesha Port 3/60/440, 1200 rpm 1944
100KVA Cooper Bessemer 8 cy 900 rpm, 3/60/220
56KVA G.E.-Climax Gasoline Portable, 3/60/220/1200 rpm
40KVA NEW Chrysler 3/60/220—2 units
30KW Buda, 3/60/220/1200 rpm
20KW Le Roi Gasoline—1/60/110-220 volt

TURBO-GENERATORS Non-Condensing

1—625KW West. 3/60/2300/3600 RPM, 125 Lb. psi, 6 Lb. B.P.
1—400KW West. 3/60/480, 150 psi., 10 Lb. B.P.
1—300KW Elliott (New 1941) 250 Volt D.C., 150 Lb. I.S.P., 20 Lb. B.P.
1—300KW G.E. 3/60/2300/100 p.s.i. 0-15 Lb. B.P.
1—300KW G.E. 3/60/2300/3600 RPM, 175 psi, 5 Lb. B.P.
1—160KW West. 3/60/220/3600 RPM, 125 Lb. psi., 10 Lb. B.P.
1—160KW Ridgeway 4 Valve Steam Engine Generator, 3/60/220
1—150KW NEW West. 250 Volt D.C. 225 Psi., 25 B.P.
1—100KW NEW 3/60/220 150/200 psi. 0/30 Lb. B.P.
1—50KW West. 3/60/220/1800 RPM, 150 psi. 10 Lb. B.P.
1—35KW G.E. 125 volt D.C., 3600 RPM

PUMPS

Centrifugal and reciprocating pumps, large stocks—1" to 20". Advise requirements.

"Everything from a Pulley to a Powerhouse"

SINCE 1915

THE O'BRIEN MACHINERY CO.

T. M. REGISTERED U. S. PATENT OFFICE

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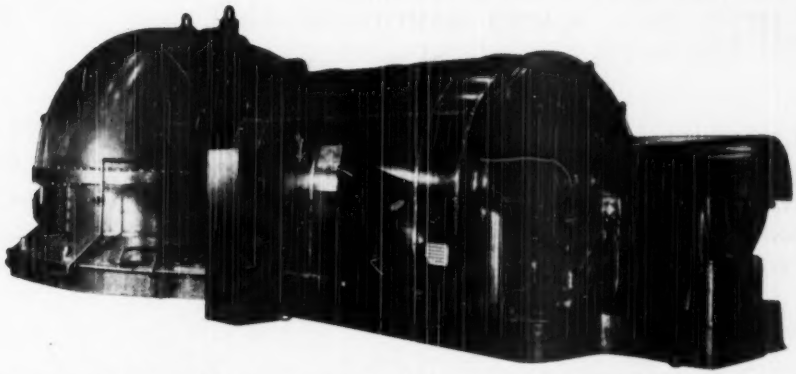
with "UTILITIES APPROVED" EQUIPMENT



25,000 KVA M—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 200-215 P.S.I.G., 540° total temperature complete with direct connected shaft exciter, switchboard and instruments, a 30,000 sq. ft. 2-pass Westinghouse surface condenser, motor driven and turbine driven pumps and condensing accessories.

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 3-stage, 2300/4000 volts, 200# P.S.I., 600°TT.

3125 KVA G.E. condens., 150#, 550 volts.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, two bearing alternating current generator LESS TURBINE.

2500 KVA G.E. condensing 200 P.S.I. 2400/600 volts.

1560 KVA Allis condensing 200 P.S.I., 2400 volts.

937½ KVA Allis condensing 250 P.S.I., 700° total temperature, 480/600/2400 volts.

625 KVA G.E. non-condensing 150 P.S.I., 20# back, 480 volt.

625 KVA G.E.—Murray condensing 250 P.S.I., 2300 volts

375 KVA (4) G.E. condensing 400# pressure, 480/600/2300/4150 volts.

125 KVA G.E. non-condensing, 150-200 P.S.I., 2300 volts.

125 KVA Westghse. non-condensing 150/250 P.S.I. 2400 volts NEW

100 KVA Westghse. non-condensing 125-150# P.S.I. 10# gauge back, 2400 volts.

Direct Current

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing

150 KW (2) Westinghouse-Worthington, 250 volts, 3-wire, 225-250 P.S.I. condens.

100 K (2) G.E. 125 volt, 200/275 P.S.I. non-condensing

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM 150# P.S.I. non-condensing.

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (3) new Westinghouse, 120 volt, 200# P.S.I. condensing.

MOTOR GENERATOR SETS

750 KW (3) Westgh. 6 phase, 60 cycle—600 volt direct current 1200 RPM rotary converters.

500 KW (3) G.E. 6 phase, 60 cycle—600 volt direct current 1200 RPM rotary converter.

150 KW G.E., 125 volt direct current generator direct connected 225 HP, 3 phase, 60 cycle, 220 volt, 1200 RPM sync!

100 KVA Westghse. 60 cycle, 2400 volt, 900 RPM alternator direct connected 135 HP, 220 volt direct current motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

DECEMBER BARGAINS

1—4400 sq. ft. Worthington surface condenser.

4—900 KW, 250/375 volt direct current generators connected 1200 HP, 720 RPM Fairanks Diesel Engines.

1—5425 GPM, 70 foot head Centrifugal pump connected 125 HP 60 cycle, 2200 volt, 1750 RPM G.E. motor.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 390# P.S.I. non-cond. G.E. turbine.

1—G.E. Bank of Scott connected 2 to 3 phase, 60 cycle transformers, 2500 KVA capacity.

2—20 KW, 125 volt Allis direct current generators each connected Hill Diesel engine.

UNAFLOW GENERATOR UNITS

Alternating Current—3 phase, 60 cycle

675 KVA G.E. 2300/480 volt generator connected horizontal engine, 150#.

625 KVA 40°C Rise, General Electric, 240 volts generator connecting Skinner non-condensing engine, 150 P.S.I.

500 KVA G.E., 2400/480/240 volts generator connected Ames Vertical Engine, 150#.

375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal Engine.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

400 KW G.E. 250 volts, 360 RPM generator connected Skinner vertical engine 150#.

275 KW Westinghouse, 250 volt generator connected Ames vertical engines, 150#.

250 KW (2) G.E., 3-wire, 250 volts generators connected Skinner engines, 150#.

150 KW Westghse. 3-wire, 250 volt generator connected Ball Engine, 150#

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Synchronous (condenser).

900 HP Allis, 2200 volts, 150 RPM.

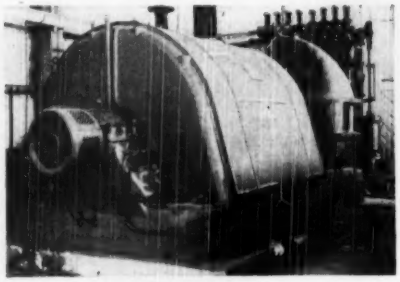
300 HP G.E., 80% P.F., 2300 volts, 720 RPM.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND-14, OHIO • Long Distance 422

5000 G. E. TURBINE GENERATOR K.W.

A VERY HIGH GRADE UNIT



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Bulletin 415 Contains Illustration and Specifications.
Send for It Today.

The Above 5000-KW., 80%-PF., 6250-KVA., G.E. Condensing Turbo-Generator Was Replaced by a 20,000-KW. Machine: Increased Capacity Requirements made Change Necessary, Not This Unit's Condition. It is in Condition for Immediate Installation. Is Good for 15 or 20 Years Service. Is a 3600-RPM Machines, 3/60/2300/4160-v., 200#-psi 600 FTT. Rigid Inspection Will Prove it to be the Best 6250-KVA., unit Available in the USA today. We Can Deliver Duty Free to Any Point in Canada or the USA. INVESTIGATE NOW.

IN OUR TURBINE STOCK TODAY WE HAVE 25 COMPLETE UNITS, CAPACITIES FROM 20,000-KW Down to 300-KW.: In Stock, 2000-KW. Non-cond.: 2—2500-KW., Cond. All in EXCELLENT CONDITION. Also all Types—Capacities Diesels: Boilers Too.

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Detroit 26, Michigan

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ALWAYS GET WEAVER'S PRICES — ARE REAL MONEY-SAVERS

MOTORS - M. G. SETS - COMPRESSORS, ETC.
FAST SHIPMENT

MOTOR GENERATOR SETS
3 ph. 60 cy.

KW	MAKE	RPM	D.C. VOLTS	A.C. VOLTS
500	Cr. Wh.	720	250	2300
300	G.E.	1200	250	4000/2300
300	West.	1280	550	4000/2300
240	G.E.	1200	250	4000/2300
200	G.E.	1200	250	4000/2300
150	West.	1200	125	2300/440
150	Ridg.	900	250	2300
100	G.E.	1200	250	2300/440
100	Ridg.	1200	250	2300/440
75	West.	900	75	440/220
50	G.E.	1200	250	440/220
35	G.E.	1800	125	440/220

Also Smaller Units In Stock

ROTARY CONVERTERS

KW	MAKE	RPM	D.C. VOLTS	A.C. VOLTS
300	G.E. HC12	600	250	4000/2300
300	G.E. HCC6	1200	250	4000/2300
150	G.E.	1200	250	4000/2300

Other sizes available

AIR COMPRESSORS
1575 CFM, 100#, PRE2 Ing. Rd. direct conn. to 265 HP, 2300 v. syn. motor.
741 CFM, 100#, OCB, Chg. Pn. belted 150 HP motor.
2—500 CFM, 100#, Allis Rotary direct connected 100 HP B.B. Motors.

A.C. MOTORS—3 Ph. 60 Cy.

HP	MAKE	RPM	TYPE
500	G.E.	450	MT412—Sl.Rg.
350	West.	600	CW1106—Sl.Rg.
300	G.E.	450	IM—Sl.Rg.
200	G.E.	1200	MI—Sl.Rg.
160	G.E.	600	IK-16—Sq. Cg.
150	West.	514	CS954—Sq. Cg.
150	G.E.	600	ATI—Syn.
125 (3)	Allis	900	ARY—Sq. Cg.
100 (3)	Allis	720	ARX—Sq. Cg.
100 (5)	West.	1200	CS752C—Sq. Cg.
100 (2)	G.E.	450	IM16—Sl.Rg.
75	West.	900	MS342 Sq. Cg.
75	G.E.	600	ITC5013A
50/12.5	G.E.	900/450	IM 2200 v.
40	G.E.	1200	MT336—Sl.Rg.

Also Smaller Units In Stock

D.C. ADJUSTABLE SPEED MOTORS
250 Volts

HP	MAKE	SPEED	TYPE
375	West.	430/860	Ped.
200	West.	400/800	SK210
150	West.	400/800	SK201
125	West.	450/1000	SK193
60	West.	435/870	SK185
50 (2)	Elec. Dyn.	190/760	

Also Smaller Units In Stock

Send us your inquiries for any POWER EQUIPMENT you may require.

MOORHEAD ELECTRICAL MACHINERY COMPANY
361 Noblestown Road Oakdale, Penna. Pittsburgh District

McBRIDE and McLENNEN
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EQUIPMENT COMPANY
POWER EQUIPMENT
AND
MACHINE TOOLS
New — Rebuilt
DELTA EQUIPMENT CO.
148 N. 3rd St. Philadelphia, Pa.
Phone: Market 71860

MOTOR - GENERATORS
Stock Shipment

	1000 KW—250 V—G.E.
	1000 KW—600 V—G.E.
	500 KW—250 V—West
(2)	500 KW—600 V—G.E.
	300 KW—600 V—G.E.
	300 KW—250 V—G.E.
	200 KW—250 V—G.E.
	150 KW—250 V—G.E.

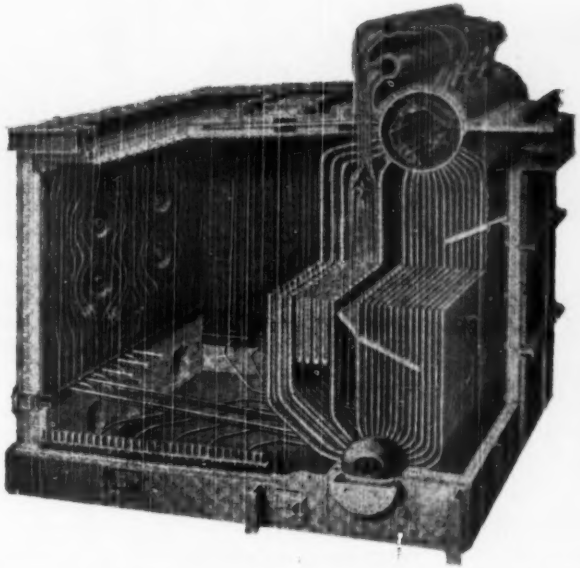
Plus 823 Smaller Units
World's Largest Inventory
Motors—Generators—Transformers
ELECTRIC EQUIPMENT CO.
63 Curlew St. Rochester, N. Y.

BOILER SPECIAL

NEW V U TYPE COMBUSTION ENGINEERING CO., WATER TUBE BOILER STATIONARY DESIGN, ASME. CODE, 600# psig., 750° FTT., DELIVERS 140,000# STEAM PER HOUR.

IMEDIATE DELIVERY

PHOTOS, DRAWINGS on File: Yours for the Asking.



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PRICED FOR QUICK SALE: STORED BALTIMORE, MD.

SAVING OF 45% ON MFRS. TODAY'S PRICE & IMMEDIATE DELIVERY

GENERAL SPECIFICATIONS

Manufacturer	Combustion Engineering Co.
Capacity	140,000# Steam per hour
Fuel	Oil, Gas, Coal (Now built for oil fuel)
Draft Fab-Induction	Buffalo Forge, Model #8
Forced Draft Fab	Buffalo Forge, Model #8
Air Heat Tubular	Superheater Convection
Heating Surface	7648-sq. ft.
No. Tubes	648-2½" x 18 ft.

WE SPECIALIZE IN: Turbo-Generators, own 25 Complete Units Outright, Capacities 300-KVA., to 25,000-KVA. with Condensers and all Auxiliaries. Also Diesel Engines, Generators.

Many other BOILERS IN STOCK.

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ABOVE V U COMBUSTION BOILER IS A REAL BARGAIN.

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Always Secure Weaver's Prices Before Buying—Are Real Money-Savers

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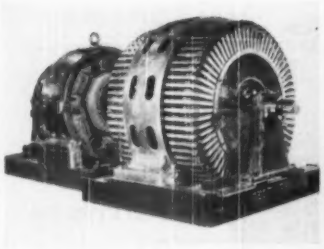
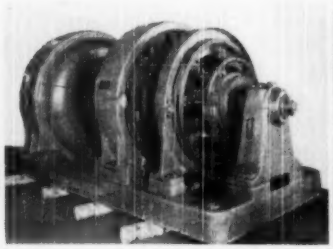
"SUCCESSFUL OPERATION GUARANTEED"

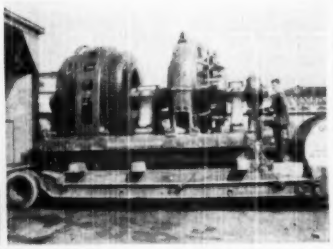
Three Recent Stock Arrivals



500 KW-MG



750 KW-MG



2000 KW-MG

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
2	2000*	G.E.	580		6600/11000
1	1800	G.E.	600	125/250	4600
1	1500	Whse.	600	600	2300/4150
1	1500	G.E.	360	275	2300/4400
1	1250	G.E.	600	275	2300
1	1000	Whse.	900	600	2300/4150
1	1000	West.	514	250	4150
1	800	G.E.(3U)	1200	120/240	2300
1	750	Al. Ch.	720	250	220/2200
1	750	Whse.	900	250	2300
1	500	G.E.	720	125	2300/4600
1	500	Whse.	900	250	2300/12000
1	500	Whse.	900	250	440
3	440	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	400	G.E.	720	600	9500
1	350	G.E.	900	125	2300/4150
1	300	Whse.	1200	250	1200
1	200	G.E.	1200	275	2300
1	150	Whse.	1200	275	2300
1	150	Whse.	1200	275	2300
1	150	Cr. Wh.	1200	250	440
1	140(3U)	Cr. Wh.	600	125/250	2300
1	100	G.E.	1170	125	220
1	75	Cr. Wh.	1170	250	220/440
1	75	G.E.	1200	250	440
6	70	G.E.	1200	70	220/410
1	60	G.E.	1200	250	2300
1	50	Whse.	1200	120	220

* 25 Cycle

ROTARY CONVERTERS

60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800
1	1000	Whse.	900	600	11000
1	750	Whse.	900	600	13200

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	G.E.	Condensing 135/150# ISP 2300/4150 Y 3 ph. 60 cy.
2	750	G.E.	Condensing 425#-725#TT ISP. 440V-3 ph. 60 cy. New—1941
1	625	Whse.	Non-condensing, 125/150# ISP, 5/30# B.P., 480 v., 3 ph., 60 cy., with exciter
1	400	Whse.	Non-condensing 125/150# ISP 5/10# BTU 40/480v. 3 ph. 60 cy.
2	400	G.E.	Condensing, 275# ISP Geared to 1200 RPM. 120/240V. D.C. Generator.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V. D. C.
2	200	Cr. Wh.	Condensing 250# ISP GEARED to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 75 B.P. 240V. 3 ph. 60 cy.

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse.		600	525/720
1—1500	Whse.		525	600
1—1200	Whse.		600	435
1—940	Whse.	QM-B.Brg.	250	140/170
1—800/1000	Whse.		450	600/720
1—650	G.E.	MPC	250	115/145
1—600	Al. Ch.	MILL	230	400/500
1—300/400	G.E.	DYNA	230	1325/2560
1—250	Cr. Wh.	CCM-151H	250	1100
1—235	Whse.	MQ	250	300/900
1—200/300	G.E.	MPC	230	300/920
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/500
1—150	G.E.		600	550/750
10—150	Cr. Wh.	83H	230	800
1—150	Cr. Wh.	CMC-65H	230	1150
1—150	Cr. Wh.	CCM-152H	230	300/1050

FREQUENCY CHANGERS

1—2500	G.E.	25/60 Cycle	2300/4150V	
1—1000	G.E.	25/60 Cycle	2300/4150V	
1—500	A.C.	25/60 Cycle	11000/2300V	

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse.		4800	720

TRANSFORMERS

60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
3	2666	Whse.	OISC	1	6600/11000
1	2500	Al. Ch.	OISC	3	13200x2300
3	1250	G.E.	H	1	6600x500
1	1000	G.E.	HT	3	13200x2300/4600
1	1050	G.E.	WCTH	3	11000x445
3	667	Al. Ch.	OISC	1	13200x230/460
3	667	Whse.	OISC	1	66000/34500x23000/2300
1	600	Al. Ch.	OISC	3	4000/2300x316
1	600	G.E.	HT	3	13200x2300/4600
3	333	Maloney	C	1	7620/13200x120/240
3	333	Pitts.	OISC	1	26400x2600
6	250	Whse.	OISC	1	11000x240
3	150	Maloney	OISC	1	13800x2300/4600
1	100	G.E.	H	1	450x230

RECTIFIERS

1— 750	G.E.	RHW	575	2300
1—1000	A.C.	B-612	625	13500
1—1000*	A.B.B.	GRZ	625	4600/13200

*This unit with full automatic control good for both 25 and 60 cycle.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	T9	2300	257
1—2100	G.E.	ATI	4600	514
3—2000	Whse.		2300	120
1—1470	Whse.		4600	900
3— 900	Al. Ch.	(New)	2200	150
1— 650	Whse.	G	2200	138
1— 600	Whse.	Syn.	440	300
1— 450	Whse.	Eng.	2300	128.5
2— 350	G.E.	T9	2200	150
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 225	G.E.	ATI 1-Brg.	440	900
1— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600

SLIP RING

3— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM-Mill	2200	450
1— 350	Al.Chal.	ANY	440	509
1— 350	G.E.	MT-442Y	2300/4000	253
1— 300	Al. Ch.	3 Brg.	2300	505
1— 300	G.E.	IM	440	720
8— 300	Al. Ch.	ANY	2200	708
1— 250	Al.Chal.	ANY	440	565
1— 250	G.E.	M-567-TEFC	440	600
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1760
3— 200	Al.Chal.	ANY	440	585
2— 150	G.E.	IM-15	440	695
2— 150	Al.Chal.	ANY	440	580
4— 125	G.E.	MT-566Y	440/2200	435
4— 100	G.E.	MT-566Y	440/2200	435
2— 100	G.E.	IM-16	2200	435
2— 100	G.E.	IM	440	600
3— 100	Al. Ch.	AK	2200	1200
2— 100	Al.Chal.	ANY	440	695

SQUIRREL CAGE

1—1750	G.E.	KF	4160/6900	900
2— 650	G.E.	FT5595Y	440	3570
2— 450	Whse.	CB	2300/4150	884
1— 300	G.E.	IK	550	885
1— 200	G.E.	KT-557	440	1800
1— 200/112	G.E.	KF-559B8	440	1170/885
3— 150	Watghse.	CS8568	440	880
1— 125	Whse.	MB	440	885
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
3— 125	Al. Ch.	ARW	2200	1750
1— 125	G.E.	IK	220	880
3— 125	Al.Chal.	ARW	2200	1750
1— 100	Al. Ch.	AR	2200	1170
1— 100	G.E.	IK-Vert.	2300	450
3— 100	G.E.	KT-543	220/440	1750
3— 75	G.E.	KT-547Y	2300	1160

RE NU BILT BELYEA MOTORS

BELYEA COMPANY, Inc.

43 HOWELL ST., JERSEY CITY, N. J.

PHONE - JOURNAL SQUARE 2-3334

N. Y. LINE - RECTOR 2-7150

POWER PLANT MACHINERY

STEAM TURBINE GENERATOR UNITS

3 Phase 60 Cycle

12,500 KVA General Electric condensing, 200# steam pressure, 500° FTT, 2400 volts, with surface condenser.

6,250 KVA Allis Chalmers condensing, 200# steam pressure, 500° FTT, 2400/4160 volts, with surface condenser.

5,000 KVA Westinghouse condensing double extraction, 400# steam pressure, 600° FTT, 125# and 20# extraction, 480 volts, with surface condenser.

4,375 KVA General Electric condensing, 200# steam pressure, 500° FTT, 2300 volts, with surface condenser.

3,750 KVA Westinghouse condensing, 150# steam pressure, 500° FTT, 2400 volts, with jet condenser.

2,500 KVA New General Electric condensing, extraction, 400/600# steam pressure, 750° FTT, 100-150# extraction, 480/2400/4160 volts, with or without new surface condenser.

2,250 KVA General Electric condensing, 400# steam pressure, 725° FTT, 2300 volts, with surface condenser.

1,875 KVA New General Electric non-condensing extraction, 400/600# steam pressure, 750° FTT, 100-150# extraction, 0-10# exhaust, 480/600/2300/4160 volts.

1,250 KVA Westinghouse condensing extraction, 150-250# steam pressure, 600° FTT, 10# extraction, 480 volts, with surface condenser.

625 KVA Westinghouse non-condensing, 150-200# steam pressure, 600° FTT, 25# exhaust, 480 volts.

312 KVA Allis Chalmers non-condensing, 150-250# steam pressure, 500° FTT, 25# exhaust, 480 volts.

SPECIAL
NEW 2500 KVA TURBINE GENERATOR UNITS
3 Phase 120-240 Cycle

3—2500 KVA General Electric Generators, 3 phase, 120/180/240 cycle, 480/2300/4150 volts, direct connected to General Electric Automatic Extraction Condensing Turbines, 400/600# steam pressure, 100/150# extraction pressure.

UNIFLOW ENGINE GENERATOR UNITS

3 Phase 60 Cycle

750 KVA Allis Chalmers-Ames vertical, 150# steam pressure, 5# exhaust, 2400/4160 volts.

625 KVA General Electric-Skinner horizontal, 150# steam pressure, 5# exhaust, 240 volts.

375 KVA General Electric-Skinner horizontal, 150# steam pressure, 5# exhaust, 240/480/2400/4160 volts.

312 KVA Crocker Wheeler-Skinner horizontal, 150# steam pressure, 5# exhaust, 480 volts.

250 KVA General Electric-Ames vertical, 150# steam pressure, 5# exhaust, 480 volts.

STEAM BOILERS

125,000 LBS. New Babcock & Wilcox boiler, 600# steam pressure, 850° FTT, oil fired.

100,000 LBS. Badenhausen boiler, 700# steam pressure, 700° FTT, pulverized coal fired.

60,000 LBS. Combustion Engineering boiler, 450# steam pressure, 600° FTT, with Coxe traveling grate stoker.

30,000 LBS. New Babcock & Wilcox boiler, package type, 435# steam pressure, 750° FTT, oil or gas fired.

25,000 LBS. Babcock & Wilcox boiler, 250# steam pressure, with Iron Fireman stoker.

DIESEL ENGINE GENERATOR UNITS

3 Phase 60 Cycle

6,250 KVA Nordberg 4150/2400 volts, 167 RPM.

1,675 KVA Fairbanks-Morse, 2400/600/480 volts, 300 RPM.

900 KVA Fairbanks-Morse, 2400 volts, 257 RPM.

625 KVA Busch-Sulzer, 2400/480/240 volts, 180 RPM.

500 KVA DeLavergne, 2400/480/240 volts, 300 RPM.

250 KVA General Motors, 240 volts, 1200 RPM.

TRANSFORMERS — 60 Cycle

NO.	KVA	MAKE	PHASE	VOLTS
1	4500	G.E.	3	26000/2300
3	4200	Pitts.	1	11000/2200
3	4000	G.E.	3	22000/2300
3	3333	G.E.	1	33000/2400
2	1500	G.E.	3	11000/480
3	1000	Allis	1	33000/6900
3	1000	G.E.	1	13200/2300
3	833	West.	1	22000/2300

Write, Wire or Phone for Further Details and Prices

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 1-9514** **CLEVELAND 14, OHIO**

LIQUIDATION SALE — Modern Equipment

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE
1800	General Motors	16-258S	900	4
1800	General Motors	16-278A	720	2
1600	Fairbanks Morse	38D O/P	720	2
1600	Hamilton	RB99-D.A.	700	2
900	General Motors	12-567 ATL	750	2
900	General Motors	6051 (quads)	650	2
500	Superior	6-cyl.	514	4
215	Superior	VDM B	600	4

DIESEL GENERATOR SETS

DC	1200 KW	525V	750 RPM	General Motors	16-278A	
	650 KW	240V	750 RPM	General Motors	12-567	
	125 KW	120/240	600 RPM	Superior	VDMB	
	100 KW	120/240	1200 RPM	General Motors	3-268A	
	60 KW	120V	1200 RPM	Buda	909	
AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	rebuilt

3—150 KW 3/60460 600 RPM Buckeye model 80 diesel
6—100 KW 3/60/460 600 RPM Worthington BB5 diesel
With Westinghouse generators, exciters, cooling systems, starting equipment, switchboard, silencers, etc. Units practically new.

TURBO-GENERATORS—D.C.

1—375 KW 180/240 V GE Shunt. 1200 non-cond.
5—300 KW 120 V Whse. Compd. 1200 cond.
1—300 KW 240 V GE Compd. 1200 cond.
12—150 KW 120 V Whse. Shunt. 1200 cond.
12— 60 KW 120 V Whse. Stab. Sh. 1800 cond.
1— 25 KW 125 V 3600

MOTORS—DC

1500 HP 525 V DC 600 RPM W'hse.
1362 HP 415 V DC 1200 RPM Elliott
667 HP 375 V DC 1300 RPM Elliott
444 HP 250 V DC 900 RPM Elliott
222 HP 230 V DC 3050 HP W'hse
50 HP 230 V DC 525/1800 W'hse.
15 HP 120 V DC 500 RPM Diehl

GENERATORS—DC

1200 KW 525 V 750 RPM All. Chalm.
1075 KW 375 V 750 RPM Elliott
700 KW 240 V 500/720 Elliott
375 KW 240 V 1200 W'hse.

AIR COMPRESSOR

2000 CFM at 90 psi, 3 stages, driven by 450 HP diesel mfr. Clark Bros.

NEW PUSHBUTTON STARTERS

2000—Line Starters, magnetic, for AC motors, rated 7½ HP at 440V, 5 HP at 230V, 3 HP at 110V, mfd. by Ward Leonard and Westinghouse.
80—Line Starters, 115V DC, 9.5 amps, G.E. (NEW).

HIGH PRESSURE AIR COMPRESSORS
CENTRIFUGES
EVAPORATORS
TRANSFORMERS
SOOT BLOWERS
WINCH TYPE MOTORS

MODERN TURBO GENERATORS AC

1—2000 KW 3 phase 60 cycle 3600 RPM 480/600/2400/4160V type ATB-2 Form HL driven by steam turbine, 410# steam pressure, exhaust 2½" Hg abs., 275 deg. F superheat. General Electric Company. (also 2900 at 1700 V)
2—250 KW G.E. type ATI 3/60/450 1200 RPM condensing.
2—200 KW Westinghse. 3/60/450 1200 RPM condensing (unused).
6—200 KW G.E. type ATB 3/60/450 1200 RPM cond. and non-cond.

GENERATORS—AC

3—2000 KW 3/60/480/600/2400/4160 3600 RPM type ATB-2 Form HL. Mfd. by G.E.

MOTORS—AC

4—6000 HP at 93-1/3 cycle 400 RPM or 3800 HP at 60 cycle 257 RPM—G.E.

ICE PLANTS (New)

2—22 ton capacity, Freon 12, mfd. by Frick.

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr 35# press.
2—Cyclotherm 3000 pounds steam per hour, 125# press.
1—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435#.
2—Type "D", water tube, Foster Wheeler, 15000# steam/hr., 275# press.

STEAM TURBINES

All New

1—110 HP 250# steam, 10# each, 1200 RPM Sturtevant
10—56.5 HP, 300-475# steam, 10-15# each. 1225-1600 RPM, Sturtevant

CONDENSERS

(Most are new)

No.	Sq. Ft.	Make	Passes	Tubes	
2	8000	C.H.Wheeler	2	Brass	⅝"
4	3300	Str. Wells	2	Alu-Brass	⅝"
4	1050	Conseco	2	Cu Ni	⅝"
30	400	All. Chalm.	2	Brass	⅝"
4	300	Wheeler	2	Cu Ni	⅝"
8	155	Conseco	2	Brass	¾"

AIR EJECTORS

1—Foster Wheeler for 3800 sq. ft. cond.
5—Westinghouse type C-42, for 9300 sq. ft. condenser.
2—Ingersoll Rand 275# press., for 8250 sq. ft. condenser.
2—C. H. Wheeler, type 4H240, for 8000 sq. ft. condenser.

HYDRAULIC PUMPS

Vertical quintuplex pumps, 450 GPM, 1750 psi, 128 RPM, mfr. Aldrich, with 700 HP 3/60/2300 motors.

AXIAL FLOW FANS

16,000 CFM 3" S.P. 3/60/440 Buffalo
12,000 CFM 3" S.P. 3/60/440 Clarage
35,000 CFM 1" S.P. 230V DC Wing

BLOWERS — AIR PUMP

5—Blowers, Roots Connersville, size 14x18, serial No. 14862, capacity 5000 CFM against 6 lb. sq. in. ga. pressure or 3450 CFM when creating 20" Hg vacuum.
1—Air Pump, Ingersoll Rand, type FS548, 5500 CFM, discharge press. 24.22 abs., intake press. 20.61 abs., with 125 HP motor 3/60/2300.
1—Air Pump, Ingersoll Rand, type FS548, 6690 CFM, discharge press. 20.86 abs., intake press. 17.10 abs., with 150 HP motor 3/60/2300.
1—Blower, Buffalo, size 60, type R, with 150 HP motor 3/60/2200.

WIRE ROPE SLINGS

Dia. from ⅝" to 2½"
Length from 10 ft. to 150 ft.

HOISTS

15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

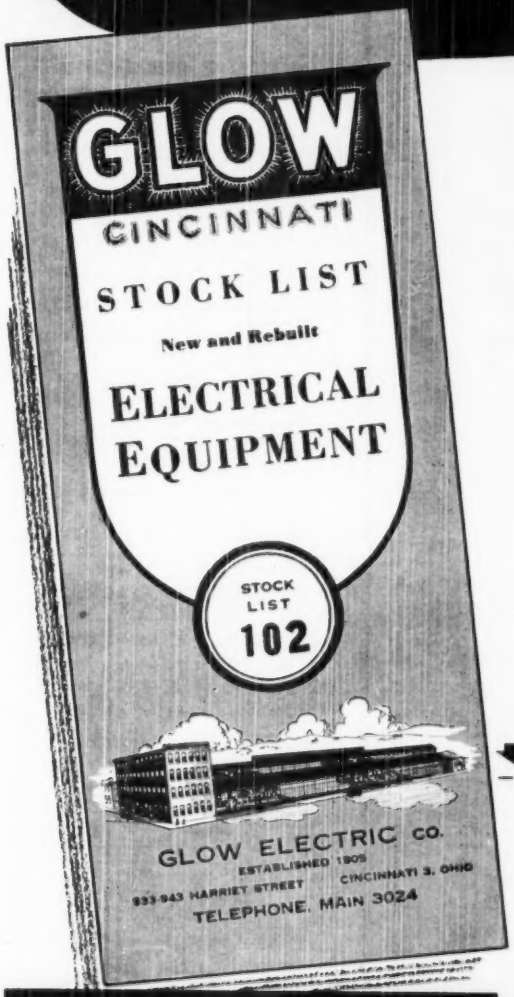
HEAT TREATING FURNACES

BOILER FEED PUMPS
FIRE, IRRIGATION AND GENERAL SERVICE PUMPS
OXYGEN PRODUCING PLANTS
WELDING ELECTRODES
REDUCTION GEARS

HUGO NEU CORPORATION

31 Nassau Street New York 5, N. Y.
Tel. REctor 2-1334

Good News for Users of ELECTRICAL EQUIPMENT



GLOW ELECTRIC CO.

Announces...

ITS NEW WINTER CATALOG
OF GUARANTEED REBUILT
ELECTRICAL EQUIPMENT

it's FREE!

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933 HARRIET ST., CINCINNATI 3, OHIO

Please send me your new winter catalog of guaranteed, rebuilt Electrical Equipment.

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933 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

WRITE FOR STOCK LIST No. 1622

VARIABLE VOLTAGE DRIVES

40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 230 Volt Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing leg forward, leg reverse, run, fast, slow, and stop, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	18	580	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
1	25	350	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	350	440	G.E.	MT-332
1	30	675	440	G.E.	MT-536
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.Ch.	ARY-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	K-536
1	50	860	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
2	52‡	550	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-938
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	865	550	West.	CW-1002
2	200	600	550*	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
1	250	600	2300†	G.E.	IM-17
1	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
1	350	880	2300	G.E.	IM-17A
1	400	505	550	West.	CW
1	600	1770	440	G.E.	IM-E15C
1	600**	860	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡Intermittent rating. *** 2 phase.
** New. ‡‡ 25 cycle.
†Also 440 or 550 volts. *Also 440 or 2300 volts

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding & Direct Connected Exciter.

Qn.	KVA	RPM	Make	Volts
4	18.7	1800	Columbia	240/120
1	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D. C. MOTORS

Qn.	HP	Speed	Make	Type
10	¾	850	Reliance	T-42T
20	3½	850	West.	8K 30
1	7½	1150	G.E.	CDM-65
1	7½	850	G.E.	CD-75
10	10‡	1750	Kimble	BA-324
4	10**	1150	Al.Ch.	EB-80
1	10	850	West.	8K-83
10	13½**	600	West.	8K-93
3	15	1750	G.E.	CD-75
5	15	825	West.	8K-90
1	30	1750	L.A.	ONA-L851
1	30	1750/1310	West.	8K-83
2	20	1150	G.E.	RC-30
1	20**	1450	G.E.	CDM-83
11	20	700	West.	8K-110L
17	25	835	West	8K-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	8K-103
1	40	700	G.E.	RC-34
1	50	750	West.	8K-150
1	50	690	G.E.	RC-16
1	60	1750/1310	West.	8K-143
1	150	700	Al.Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	HP	Speed	Make	Type
6	5/7½	600/1800	G.E.	Ra-30
1	10	400/1600	Reliance	T-92T
2	10/15	900/2400	Reliance	T-92T
1	12½	650/840	West.	8K-120
10	12½**	600	West.	8K-93
1	15	600/1200	West.	8K-100L
2	20	500/1800	G.E.	RF-11
1	20/25	100/1200	West.	8K-153
1	25	600/1800	G.E.	RF-13
1	25	500/1500	G.E.	RF-13
1	25/30	300/1200	G.E.	RF-13
1	30	400/1200	West	8K-163
1	30/40**	400/1600	G.E.	CD-1236
35	35	600/1500	West	8K-143
1	40/50	400/1200	Reliance	T-401
1	75	600/1500	Cr.Wh.	CCM
1	75	375/750	Cr.Wh.	CMC-125M
3	100	225/800	G.E.	MPC-A
5	100	400/1200	Al.Ch.	
1	100	320/900	West.	8K-200
1	125	450/1000	West.	8K-190
1	175	250/800	West.	8K-220
2	375	350/800	G.E.	MPC

**New.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CB-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXP
1	15	1745	440	West.	CB-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3565	440	G.E.	KF-4059

SPLASHPROOF, BALL BEARING

Qn.	HP	RPM	Volts	Make	Type
24	5	1750	440	L.A.	FS-254
1	5	1745	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
9	15	1150	440	L.A.	FX-366
2	40	1175	220	G.E.	K-445
2	50	1760	440	L.A.	FX-445A
6	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1168
3	150	890	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-5335
1	200	885	440	L.A.	FS-1378

OPEN TYPE MOTORS

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-13247
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
6	20**	1750	440	Wagner	RP1-364
1	20	1740	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
3	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
1	25	1200	220	G.E.	KT-512
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-556***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
5	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3565	220	G.E.	KF-4048
2	40	1760	440	West.	CS-383C
2	40	900	2300	G.E.	FTR-536
4	50**	1760	440	Wagner	RPo-405
1	50	850	220	West.	CGL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-546
1	75	1160	440	West.	CS-962C
1	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-852
1	100	690	220	West.	C
1	100	580	2300	G.E.	IK-15A
2	100	580	2200	West.	CS-930
1	100	495	2300	Al.Ch.	AN
2	125	425	440	Al.Ch.	AR
2	125	900	2300	G.E.	I-17-FR
1	200	580	4500‡	G.E.	KT-5668
4	300	587	2200	West.	CS-39A
1	400	1165	2300	G.E.	IK-E15B
1	500	1200	440	G.E.	KTF-567
1	700	1800	2300/ 4000	West.	CS-4-39D-12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts.

G. E. DYNAMOMETER

Cradle Type, with control and Dial Scale.
(Write for Complete Specifications.)

Qn.	HP	DC Volts	RPM	Type
1	200	250	1200	C

MOTOR GENERATOR SETS

125 and 250 Volts D. C.
(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220‡
10	West.	1760	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440‡
16	West.	1750	125	2300/440
20	West.	1760	250	220/440
25	G.E.	1200	125	220/440
30	G.E.	1800	250	220/440
30	Al.Ch.	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	1720	125	220/240†
75	G.E.*	1200	125	220/240

Note: 3KW, 5KW & 7.5Kw, 250V Sets Available
**New. *Synch. Motor Driven. ‡50 Cy. 125 Cy.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO

MOTOR GENERATOR SETS

1—300 KW G.E. Syn. 250 V. 900 RPM
2—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW G.E. Syn. 600 V. 1200 RPM
1—240 KW G.E. Syn. 250 V. 1200 RPM
2—200 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW Ridgway Ind. 250 V. 900 RPM
2—100 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTER

1—300 KW G.E. Syn. 250 V. 1200 RPM HCC, 6 Ph. 60 Cy. Transformers
1—150 KW G.E. Syn. 250 V. 1200 RPM HCC, 6 Ph. 60 Cy. Transformers

ARMATURES

1—500 KW G.E. 250 V. MPC Gen. 900 RPM
1—300 KW G.E. 600 V. HCC Conv. 1200 RPM

WALLACE E. KIRK COMPANY

502 Grant Bldg., Pittsburgh 19, Pa.

CENTRIFUGAL PUMPS

4—Allis Chalmers Electrifugal, Size 6" x 5" SSL 20 H.P., 220 or 440 volt, 3/60—1800 RPM, Splash proof. Cap. 1000 GPM, 68' head.
2—Fairbanks-Morse, Size 3"—5532 with 15 H.P. 220/440/3/60—1800 RPM, Splash proof motors. Cap. 300 GPM, 100' head.
2—Vacuum, Size O Nash Hytor, 50 CFM, 15" hg.
2—Beach-Russ, Size 5, Vacuum, 60 CFM, 26" hg.

MOTORS

1—50 H.P. G.E. Slip Ring 220/3/60—900 RPM with drum and grids.

Large stock of pumps, motors and air compressors at all times. Let us have your inquiries.

C-B EQUIPMENT AND PUMP CO.

1440 N. Broadway, St. Louis 6, Mo.
CH 1101 CH 7165

TRANSFORMERS

4—500 KVA, G.E., 14850-16500 to 230 -460 Volts, Form L, Type A.
4—833 KVA, G.E., 16500 to 460 Volts, Form VDHJ, Type H.

ROGER PIERCE EQUIPMENT SALES CO.

808 Newhouse Building
Salt Lake City, Utah
Phone 33973

BOILERS

100 HP Scotch Oil Fired 15 lbs.
90 HP Keeler B.D. 125 lbs.
80 HP Erie Economic 125 lbs.
75 HP Lewsel Scotch 125 lbs.
Other types & sizes in stock.

M. J. HUNT'S SONS

1620 N. Delaware Ave.
Phila. 25, Penna.

FOR TOP VALUE AND GUARANTEED PERFORMANCE

Make a Beeline for CHICAGO *Electric*

HOME OF GUARANTEED REBUILT ELECTRICAL POWER EQUIPMENT

HERE'S A PARTIAL LISTING OF OUR HALF-MILLION DOLLAR STOCK

SQUIRREL CAGE MOTORS

3 phase, 60 cycle
220 or 440 volt
*(2200 volt or higher)

H.P.	Make	Type	Speed
750	*G.E.	KT	720
700	*G.E.	IK	600
600	*Westg.	CS	1200
500	*G.E.	I	450
500	G.E.	I	450
400	*G.E. ExPf.	K	3600
400	*G.E.	IK	1800
400	*CentSpPf	K	1200
400	*Al.Ch.SpPf	ANW	900
400	*Westg. Vert	CS	720
400	G.E.	IK	514
400	*G.E.	KT	450
350	*G.E.	IK	3600
350	*Al.Ch.New	ARW626	3600
350	*Cr.Wh.	S	600
325	G.E.	KT	385
300	*Westg.	CS	3600
300	G.E.	FT-559	1800
300	G.E.	KF-559	1200
300	*G.E.25 cyc	IK	750
300	*G.E.	IK	514
250	Al.Ch.TEFC	ARWW	3600
250	G.E.	FT-549	3600
250	Westg.	CS	1800
250	Al.ChNEW	ARW630	900
250	Westg.	CS956A	600
250	*G.E.	IK	514
200	*Al.Ch.New	ARW-623	3600
200	Wagner	RP	1800
200	*G.E.	IK	1200
200	G.E.	IK	900
200	Westg.	CS	720
200	*Al.Ch.	AN	720
150	G.E.	IK	1750
150	Westg.	CS	1750
150	G.E.	IK	1200
150	Al.Ch.New	AZ	1200
150	*G.E.	IK	1200
150	Westg.	CS-950A	900
150	G.E.	IK	900
150	G.E.	IK	720
150	G.E.	IK	600
200	G.E.	KTP	1800
150	*G.E.	IK	450
125	Westg.	CS	3600
125	*Al.Ch.	AR226	1800
125	G.E.SpPf		1800
125	G.E.TEFC	K-6326	1200
125	Al.Ch.	AR	900
125	CR.Wh.		430
100	Al.Ch. New	AR-504	3600
100	*G.E.	FT-542	1800
100	G.E.	KT	1800
100	Westg.	CS-752	1200
100	U.S.Vert	CFU	1200
100	Al.Ch.	AR	900
100	G.E.	KT	900
100	Al.Ch550V	AR	900
100	G.E.	KT558S	720
75	G.E.	FT	3600
75	Al.Ch.New	AR	1800
75	Westg.	CS-505	1800
75	Westg.	CS-761	1800
75	G.E.New	K-505	1200
75	*Westg.	CS	1200
75	Westg.Vert	CS	900
75	Al.Ch.New	ARW-823	900
75	G.E.New	K-6333	720
75	G.E.	I K	720
75	Al.Ch.	AN	720
75	Ideal	A-A350	720
75	G.E.	IK	600
75	Triumph	TR-16	514
60	G.E.New	K-444-S	1800
60	Westg.	CS-444	1800
60	Westg.Vert	CS-445	1800
60	G.E.New	K-504	1200
60	Al.Ch.New	AR-823	900
60	Al.Ch.	AR-826	514
50	Westg.	CS-640	1800
50	Al.Ch.	AR-445-S	1800
50	U.S.Vert	SCU-937	1800
50	G.E.	K-405	1800
50	G.E.	K-445	1200
50	Westg.TEFC	CS-504	1200
50	U.S.	FR-667	1200
50	G.E.	KT-342	900
50	G.E.	I.T.	900
50	Westg.	C.S.	900
50	Burke	EM-7	900
50	G.E.	I K.	600
40	*Al.Ch.	ARX-404	3600
40	G.E.	KF-404	3600
40	G.E.	KT-323	3600

SLIP RING MOTORS

3 phase 60 cycle
220 or 440 volt
*(2200 V or higher)

H.P.	Make	Type	Speed
2500	*Westg.	CW-Mill	720
2500	*G.E.	MT	257
2000	*G.E.	MT-30	240
1200	*G.E.	MT-26	277
1000	*Westg.	CW-Mill	720
700	*Westg.	CW	720
650	Westg.	HE	360
500	*G.E.	IM	600
500	Westg.	CW	360
450	G.E.	IM	514
400	G.E.	IM	505
400	*Westg.	CW	400
350	*Westg.	CW	600
350	Al. Ch.	ANY	600
300	*G.E.	IM	1800
300	Al. Ch.	ANY	720
300	Al. Ch.	ANY	600
300	*G.E.	IM	450
250	Westg.	CW	1800
250	G.E.	IM	1200
250	Westg.	CW-32B	900
250	Al. Ch. New	ARY	720
250	Al. Ch.	ANY	600
250	G.E.	IM	450
200	Westg.	CW	1800
200	Al. Ch. New	ARY	1200
200	Westg.	CW	900
200	Al. Ch.	ANY	600
200	*G.E.	IM	600
200	G.E.	IM	600
200	G.E.	IM	1750
150	Westg.	CW-772	1200
150	*Westg.	CW	1200
150	Westg.	CW-870C	900
150	Westg.	CW	720
150	G.E.	IM	720
150	*Westg.	CW-868A	600
150	Al. Ch.	ANY	600
150	G.E.	IM	514
125	*Westg.	CW	1200
125	G.E.	IM	1200
125	G.E. New	M-6333	900
125	G.E. New	M-6334	720
125	Al. Ch. New	ARY	720
125	G.E.	IM	600
100	Westg.	CW	1200
100	G.E.	IM	900
100	Al. Ch.	ANY	720
100	*Westg.	CW-856C	600
100	Gen. Elec.	IM	450
75	G.E.	IM	1800
75	G.E.	MT-547	1200
75	*Westg.	CW	1200
75	Star	0c00	900
75	*G.E.	M.T.	900
75	Al. Ch.	ANY	720
60	G.E. New	M-505	1200
60	*Westg.	CW-762C	900
60	Al. Ch. New	ARY	900
60	G.E.	IM	1750
50	*Al. Ch.	ARY	1750
50	Westg.	CW-636A	1200
50	Westg.	CW-642C	1200
50	Al. Ch. New	ARY-505	900
50	G.E.	IM	435
40	G.E.	IM	1200
40	G.E.	MT-336	1200
40	Westg.	CW-644C	900
40	G.E. New	M-504	900
40	Al. Ch.	ARY-221C	720
35	F.W. Vert	UAB	1800
35	G.E.	IM	1200
30	G.E.	MT-332	1200
30	G.E.	MT	900
25	G.E.	IM	1200
25	Al. Ch.	ARY-220C	900
20	G.E.	MT-503	1800
20	Al. Ch.	ARY216D	1200
20	G.E.	MT-322	900
20	G.E.	IM	720
20	G.E.	IM	600
20	Westg.	CW-644C	600
15	L.A.	OH-326	1800
15	G.E.	MT	1200
15	Al. Ch.	ARY-216	900
15	Westg.	CW	900
10	Westg.	CW-320	1200
10	Al. Ch.	ARY-215	900
7½	L.A.	OH-324	1200
5	G.E. (srt.)	IM	900
3	G.E.	MT	1200
2	G.E.	MT-934	1200
1½	Westg.	CW-166	1200
1	G.E.	MT-732	1200

SLIP RING MOTORS

Crane and Hoist Type
3/60/220 or 440 volt

H.P.	Make	Type	Speed
75	Westg.	CI-756A	600
52	G.E.	ITC-5013	600
37	G.E. TENV	HITC	600
25	Westg.	CI-572A	900
20	Westg.	CI-570	900
18	G.E.	MTC5056	1200
15	G.E.	MTC5056	1200
15	G.E. 25 cyc	ITC-5018	720
6.5	R&M TENV	425A	1200
5	G.E.	MTC5180	1200
3	G.E.	MTC5160	1200
3	G.E. TENV	MR-254	1200
2.5	G.E.	MTC5150	1200
2.5	Star	AR827	1200
2	G.E.	MR-225	1200

A. C. SYNCHRONOUS MOTORS

3 phase, 60 cycle
220 or 440 volt
*(2200 V. or higher)

H.P.	Make	Type	PF	Spd
2100	*G.E.	ATI	.8	3600
1750	*G.E.	ATI		3600
1000	*Westg.	ATI	.8	514
700	*G.E.	ATI	.8	720
600	G.E.	TS	I.	514
600	Westg.	Eng.	I.	257
450	El. Mchy	Ped.	I.	240
450	G.E.	TS	I.	257
400	G.E.	TS		600
320	*Al. Ch.	Dr. Pf.	I.	720
250	*Al. Ch.	Dr. Pf.	.8	720
225	El. Mchy.	Ped.	I.	450
150	El. Mchy	EM	.8	720
125	G.E.	TS954S	I.	1200
125	Cr. Wh.	103-S	I.	900
125	*El. Mchy	EM	I.	900
100	G.E.	TS954S	.8	1200
100	Cr. Wh.	103S	.8	900
100	G.E.	ATB	.8	900
75	G.E.	ATB	I.	900
60	G.E.	TS7536	I.	1200
20	Fynn W.	15VRN		1200
15	Century	ARC365	I.	1200
4	G.E.	AK25cyc		1500

MULTI-SPEED MOTORS

3 phase, 60 cycle

H.P.	Make	Volt	Speed
40/20	Linc.	220	9 450
25/7	Howell	440	18/12.9 600
20	Reliance	440	18/12.9 600
15	G.E.	440	9 450
7½/2½	Reliance	440	18/12.9 600
7	G.E.	220	18 1200
6	G.E.	220	18/12.9 600
6	G.E.	440	18/12.9 600
6	G.E.	440	12 600
3½	G.E.	220	18/12.9 600
3	U.S.	220	18 900
2	G.E.	440	18/12 900
1½	Wagner	440	18 900

A. C. GENERATORS

3 phase 60 cycle
220 or 440 volt
*(2200 V. or higher)

KVA	Make	Type	PF	Spd
2000	*Westg.	Eng.	.8	720
1500	G.E.	ATI	.8	900
1000	Westg.	503D	.8	900
1000	*Westg.	Eng.	.8	180
750	Elec. Mch.	Eng.	.8	180
725	*G.E.	ATI	.8	720
600	*G.E.	Eng.	.8	180
350	*Westg.		.8	300
250	*Al. Ch.	Skirted		720
150	Elec. Mch.	EM	.8	720
112.5	*G.E.	ATB	.8	1200
112.5	G.E.	TS-954	.8	1200
110	Cr. Wh.	103	.8	900
100	G.E.	ATB	.8	900
60	F.M.	D-ENG	.8	300
60	F.M.	8.	.8	900
50	G.E.	ATB	.8	1200
50	Westg.		.8	1200
50	Cr. Wh.	5086	.8	1200
30	Roth	128RS	I.	1800
30	Al. Ch.	EA-121	.8	1800
15	National	NWV		1800
4	G.E.	TLA		900
2.5	Leland	KL		1800

MOTOR GENERATOR SETS

KW	Make	A.C.	D.C.
1000	G.E.	4600	275
500	G.E.	2300	230
500	G.E.	4600	1200
300	Westg.	2300	230
450	G.E.	2300	250
200	Cr. Wh.	2300	125
200	G.E.	440	250
150	G.E.	440	250
100	G.E.	440	250
75	Star	440	250
75	G.E.	440	250
60	Al. Ch.	2300	110
50	Westg.	220	110
40	Cr. Wh.	440	250
40	Al. Ch.	220	125
25	G.E.	440	250
30	Cr. Wh.	220	125
20	G.E.	440	250
20	G.E.	440	125
10	G.E.	440	250
10	Cr. Wh.	220	125

LOW VOLTAGE—M.G. SETS

Amp.	Make	A.C.	D.C.
1500	G.E.	2300	60
1500	G.E.	440	20
1000	Chandyn	440	40
1000	G.E.	440	35

BALANCING SETS

4—34 K.W., 250 V., 270 A. new. Boque, type MCI, 125 V. gen. BB comp'd d.c on tab base

2—20 K.W., 250 V., 160 a. new. Cr. Wh. type 1SL, 125 V gen 3 sl. brg close coupled.

D. C. MOTORS

230 Volts

H.P.	Make	Type	Speed
800	Westg. 600 V	Q	375
350	G.E.	CD-1684	1200
250	Cr. Wh.	CMC-101	1200
222	Westg.	SK-153	2975
200	G.E.	CVC	925
200	Reliance	1970T	675
150	Westg.	SK-154L	1750
150	Westg.	SK-183	1100
150	Cr.Wh. BB	83-H	1200
150	G.E.	IC	900
125	G.E.	RC-15	1750
100	G.E.	RC-34	2500
100	G.E.	RC-58	650
80	Cr. Wh.	CCM	450
75	Fairb.-Mer. (NEW)	CP	1750
75	Reliance	T	1750
75	Cr. Wh. BB	CMC	1150
60	Westg.	SK-133	1200
60	G.E. 550 V.	CD	1000
40	Al. Ch.	E-131	850
40	G.E.	RC-34	750
50	G.E.	RC-35	700
40	G.E.	CO-2004	800
40	Roth	FR-406	850
35	Cr. Wh.	CM-351	700
35	Sprague	C	600
30	Westg.	SK-120	975
25	Cr. Wh.	CCM	450
25	Westg.	SK-100L	1100
25	Westg.	SK	900
25	Al. Ch.	E	700
20	Westg.	SK-83	1750
20	G.E.	RC	1150
20	Westg.	SK	900
20	G.E.	RC	800
20	Sprague	LC	575
15	Cr. Wh.	BH	1750
15	Westg.	SK-83	1750
15	G.E.	RC-10	1150
15	G.E.	RC-29	1150
15	G.E.	RC-49	1150
15/7	G.E.	CE-4	1100
15	Westg.	UVC-13	825
15	G.E.	CVC	825
15	Westg.	SK	825
15	Cr. Wh.	CM	800
13	Louis Allis	NA-955	600
10	Westg.	SK-43	2075
10	Westg.	SK-5	1150
10	Westg.	SK-60L	1150
10	G.E.	RC-20A	1150
10	G.E.	CD-75	1150
10	G.E.	RC-9	1150
10	G.E.	CD-75	1150
10	G.E.	CD-75	1150
10	G.E.	RC-49	900
10	Al. Ch.	E-90	850

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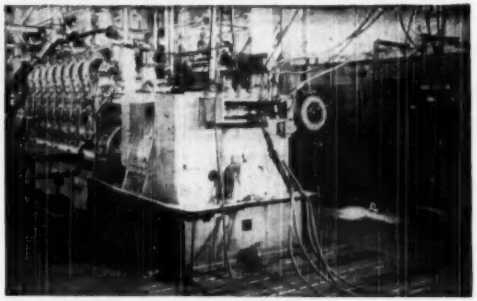

VIEW OF ENGINE TEST STAND FACILITIES AT OUR PLANT IN SAUSALITO (S.F.) CALIF. ALL ENGINE TESTING CONFORMS TO DIESEL MANUFACTURERS' STANDARD METHODS.

A PARTIAL LIST OF OUR INVENTORY

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1875	Fairbanks Morse	33E16	2000	300	312.5	Clark	MD-4	375	327
1420	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	YVA	360	257
1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1000	General Motors	12-278A	1200	720	237	Ingersoll-Rand	S	255	600
937.5	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Alco	6-12½x13T	750	600	156	Buckeye	E	190	400
425	Baldwin	VO	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	121	Fairbanks Morse	32E14	140	300
375	Enterprise	DSG-6	450	450	75	General Motors	6-71	90	1200
330	Superior	KNA	396	514	62.5	Int'l Harvester	UD-18	76	1200
312.5	General Motors	8-268A	450	1200	50	General Motors	4-71	60	1200

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100 K.W. Allis Chalmers. 1944. 3/60/120/450.
Exciter: 3 K.W. 120 V. D.C.
Diesel Engine: Lorimer. Model F5SS. 150 H.P. 7½"x9½".
5 cylinder, with electric starting motor.

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Westinghouse. 1944. Synchronous—Induction.
60 Pole, 3300 S.H.P. 3 Phase. 82.5 Cycles. 2200 Volts.
165 R.P.M. Power Factor 100%.
Exciter: 125 Volts D.C. Load Factor 100%. 1944.

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WATER TUBE. Babcock & Wilcox. 1945. 2 Drum. Bent Tube. Economisers. Internal Desuperheater. Superheaters. W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

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3—1250 KVA—G.E. 13800 2400
3—1000 KVA—G.E. 13800 480
3—1250 KVA—G.E. 6900 480
3—1000 KVA—G.E. 4800 480
6— 500 KVA—West. 2400 240/480
9— 333 KVA—West. 6900 480
9— 333 KVA—West. 4800 480
9— 333 KVA—West. 2400 480
3— 200 KVA—G.E. 2400 480/240
3— 150 KVA—G.E. 2400 480/240
3— 100 KVA—G.E. 2400 480/240
3— 100 KVA — G.E. 6900/11950Y 460/230
3— 75 KVA—West. 4800/2400 460/230
3— 50 KVA—G.E. 4800/2400 460/230/115
3— 37½ KVA — G.E. 4800/2400 460/230/115

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1—250 HP B&W water tube 170#
2—150 HP H R T 150#
1—410 HP Heine water tube 200#
1—505 HP Brise water tube 200#
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8—25,000 Gal. Cap. Horizontal
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6—10,000 & 12,000 & 16,000 Gal. ⅜" Shell
20—10,000 Gal. Cap. 60 lbs. Press. Test

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MODERN 1000 KW Turbo-Generator
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Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

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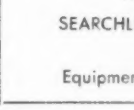

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M-G SETS

KW	Mfr	Input V	Output V
500	Whse.*	2300 AC	250 DC
300	G.E.*	2200/440 AC	275 DC
300	Whse.*	2300/4000 AC	600 DC
200	Ridgeway*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Burke*	250/440 AC	250 AC
100	Century b.b.	220/440 AC	70 DC
100	Duke (3)	220/440 AC	125/250 DC
100	Allis Ch.* (2)	2300/440 AC	60 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
75	Star* b.b. NEW	220/440 AC	250 DC
65	Whse.	220/440 AC	250 DC
60	Gen. Elec.	220/440 AC	30 DC
50	Gen. Elec.	220/440 AC	250 DC
45	Cr. Wh. b.b. (2)	220/440 AC	125 DC
40	Whse. (2)	220/440 AC	125 DC
40	N.W. conv.	220 AC	250 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b. (3)	220/440 AC	125 DC
35	G.E.	220/440 AC	18 DC
25	Burke	220/440 AC	125 DC

*Syn. motor drive.

D. C. MOTORS

HP	Mfr	Type	Volts	Speed
350	Gen. Elec.	RMC	250	550
200	Reliance	1976T	230	575/750
150	Cr. Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	450/800
100	Gen. Elec.	C	230	575/1000
75	Allis Ch.	E-149	230	500
75	Northw'n	K20	230	1750
75	Cr. Wh. NEW b.b.	CMC-HH	230	1150
75	Century NEW	DN	230	850
75	Whse.	SK160	230	850
60	Gen. Elec.	BC 38	230	425/850
60	Cr. Wh.	50H	230	700
60	Century NEW	DN	230	1150
50	Whse.	SK127	115	1450
50	Gen. Elec.	R.C. 14	250	1050
40/60	Whse.	SK160	230	500/1000
40	Cr. Wheeler	EH	230	1750
40	Whse.	SK110L	230	1750
40	Whse. (2)	SK126	230	950
35/50	Gen. Elec.	CD123	230	575/1150
30	Cr. Wheeler	DH	230	1750
25	Whse.	SK150	230	300/1200

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D. C. GENERATORS

HP	Mfr	Type	Volts	Speed
300	Gen. Elec. 1 brg.	DMC	275	720
200	Reliance	1976T	250	720
150	Cr. Wheeler b.b.	TEFC	250	1200
100	Century b.b.	1500 amp	70	1200
100	Gen. Elec.	C	250	1150
100	Gen. Elec.	DLC	125/250	675
75	Cr. Wh. NEW b.b.	HH	250	1450
75	Allis Ch.	E	250	750
75	Gen. Elec.	BC36	125	1200
65	Whse.	SK160	250	1100
60	Gen. Elec.	BC	250	575
50	Gen. Elec.	R.C. 14	250	1200
50	Cr. Wheeler	50H	250	900
45	Cr. Wh. b.b.	FH	125	1750
40	Whse.	SK	250	1200
25	Cr. Wh. b.b.	EH	125	1750
25	G.E. b.b.	BM	95	1200

A. C. MOTORS—25 CYCLE

HP	Mfr	Type	Volts	Speed
150	Whse.	HF	440	500
150	Gen. Elec.	IK-16	440	750
100	Gen. Elec.	I-K	440	500
50	Gen. Elec. Int.	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
50	Gen. Elec.	KT339	440	1500
40	Gen. Elec.	KT343	440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
500	Allis Ch.	3 brg.	240/480	360
500	Gen. Elec.	ATB	600	720
375	G.E. 25 cycle	ATB	600	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
187	Gen. Elec. (2)	ATB	240/480	900
156	Elec. Machy.	3 brg.	240/480	900
150	Gen. Elec.	ATB	240/480	900
125	Gen. Elec.	ATB	240/480	720
125	Gen. Elec.	ATB	240/480	1200
100	El. Machy.	B.B.	2400	900
75	G.E. b.b.	ATI	240/480	1200

A. C. MOTORS—SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec.	I-M	514
1—	400	Gen. Elec. 2300V.	I-M	1800
1—	300	Whse. 2200V.	CW	600
2—	300	Allis Ch. 2200V.	ANY	720
1—	300	Gen. Elec. 2200V.	I-M	1800
1—	300	G.E. b.b. New	M500	900
1—	250	Allis Ch. 2200V.	ANY	514
1—	200	G.E. 2200V.	I-M 17A	450
2—	200	Gen. Elec. 2200V.	I-M-16	600
1	200	Gen. Elec.	I-M	360
2—	150	Gen. Elec.* 2200V	I-M-14	600
1—	150	G.E. 2200/4000V.	I-M	1200
1—	150	Allis Ch.	ANY	600
1—	150	Gen. Elec.	I-M-17	450
1—	125	Gen. Elec.	I-M-13	720
2—	100	Gen. Elec.	I-M	1800
1—	100	G.E. Vertical	MT553	1200
2—	100	Gen. Elec.	IM-15A	514
1—	100	Northeastern	BWT5A	900
1—	100	Gen. Elec.	I-M	720
1—	75	Howell	9R443	1800
1—	75	Gen. Elec.	I-M-13	1200
2—	75	Gen. Elec.	I-M-14	720
1—	75	Gen. Elec.	MT536	600
1—	75	G.E. 2200V.	MT536	720
1—	50	Allis Ch.	ANY	900
1—	50	Howell	9R437	1200
1—	50	Gen. Elec. 104	IT5013	600
1—	50	Gen. Elec.	I-M	720
1—	50	Gen. Elec.	MT536	1200
1—	50	Whse.	CW634A	1200
1—	40	Gen. Elec.	MT536	900
1—	40	Gen. Elec.	MT346	600

A. C. MOTORS—SYNCHRONOUS

HP	Mfr	Type	Volts	Speed
600	Gen. Elec. (2)	TS	2200	514
300	Whse.	G	2200/440	600
300	Gen. Elec.	ATI	440	720
250	Gen. Elec.	TS	220/440	360
220	G.E. 3 brg. SPF	ATI	220/440	600
200	G.E.	TS	220/440	150
200	G.E. SPF	ATI	220/440	900
190	El. Machy.	3 brg.	220/440	514
150	Gen. Elec.	ATI	220/440	580
150	American b.b.	YHH	220/440	900
125	El. Machy. (2)	B.B.	2400/4800	900
125	Whse. (2)	late	2200	1800
75	Whse.	SPF late	220/440	1200

A. C. MOTORS—SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	325	Gen. Elec.	KT420	600
1—	300	Allis Ch. 2200V.	AN	720
1—	250	Gen. Elec.	FT5104Z	3600
1—	250	Gen. Elec.	FT540	3600
1—	250	Whse.	C9954A	720
1—	200	Allis. Ch.	AN	1200
1—	200	Whse. b.b. NEW	C8875	1800
1—	150	Gen. Elec.	I-K	900
1—	150	Gen. Elec. TEFC b.b.	R63338	1200
1—	150	Gen. Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	B6085	1200
2—	150	Reliance b.b.	B47537	1200
1—	150	Gen. Elec. 2200V	IK-13A	1800
1—	125	Reliance b.b. NEW	C5085	1200
1—	125	Gen. Elec.	I-K-16	450
1—	125	Gen. Elec. 2200V. b.b.	8C	1800
2—	125	Rel. TEFC NEW	B6085	1800
3—	125	F.M. 2200V. vertical	UH-16D	1200
1—	100	Gen. Elec.	I-K	720
2—	100	Allis Ch. 2200V.	AR326	1200
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	Gen. Elec. b.b. NEW	K5018	1800
1—	100	Allis Ch.	AR	900
2—	100	Reliance TEFC	C5085	900
1—	75	Fair. Morse b.b.	BJQ	600
1—	75	Reliance b.b. NEW	C8084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C5085	1800
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Reliance b.b. NEW	C5085	1200
1—	60	G. E. hitorq	KG1504	1200
1—	60	Howell b.b.	9R584	720
2—	60	Reliance b.b. NEW	C5084	1800
2—	60	Reliance TEFC NEW	C5085	1200
2—	60	Reliance b.b. NEW	C5084	1200
2—	50	Whse. H.T.	CB2547	1800
1—	60	Wagner b.b.	RP444	3600
1—	60	Gen. Elec.	KT342	1200
1—	50	Gen. Elec.	KT536	1200
1—	50	Whse.	CR	1200
1—	50	G.E. NEW b.b. HT	KG4005	1800
2—	50	Reliance b.b. NEW	C445	1200
1—	50	Whse. hi-tip	WL607	900
1—	50	Allis Ch. 2200V.	AR445	1800
1—	50	Gen. Elec.	KT540	720
1—	40	Gen. Elec.	T342	720

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1— 5000 KVA West. Extr. Cond. 60 cy. 2300 V. 385-lb.
1— 5000 KVA G. E. Non-C. 60 cy. 13200 V. 600-lb.
1— 2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lb. 40-lb. BP
1— 2500 KVA G. E. Extr. Cond. 60 cy. 480 V. 185-200 lb. steel valve chest.
1— 2500 KVA G. E. Cond. 60 cy. 2300 V. 150-lb.
2— 2250 KVA G. E. Cond. 60 cy. 240-400 lb.
1— 1875 KVA Moore Cond. 60 cy. 2300 V. 275-lb.
1— 1563 KVA G. E. Extr. Cond. 60 cy. 480 V. 200-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
2— 1250 KVA Elliott Cond. 60 cy. 480 V. 150-200 lb. 600" Surface Condenser
1— 938 KVA G. E. Extr. Cond. 60 cy. 240 V. 200-lb.
1— 625 KVA G. E. Cond. 60 cy. 240 V. 200-lb.
1— 375 KVA G. E. Non-C. 60 cy. 2300 V. 200-lb. 14-lb. BP
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor

DIESEL ENGINE UNITS

2—1400 HP Fair. Morse 2400 V. 60 cy.
3— 700 HP Gen. Motors 2300 V. 60 cy.
3— 650 HP Amer. Loco. 440 V. 60 cy.
1— 600 HP Fair. Morse 2400 V. 60 cy.

STEAM ENGINE UNITS

1—312 KVA Ames Uniflow 240 V.
1—250 KVA Ames Vertical Uniflow 480 V.
1—250 KVA Ames Uniflow 480 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—150 KVA Ames Vertical Uniflow 240 V.

ROTARIES—60 CY.

QU.	KW	MFR.	VOLTS-DC	TRANS.	RPM
1	3230	G.E.	225/285	13800	300
1	2000	A.C.	600	4150	514
2	1000	West.	600	4150	720
1	1000	G.E.	600	13200	900 Auto.
3	750	West.	600	11000	1200 Auto.
2	500	West.	250	13200	1200
2	150	West.	250	2200	1200

SPECIALS

3—700 HP General Motors Diesel 8 cyl. 4 cy. 360 RPM dir. con. to 485 KW .8 PF 3/60/2300 V. generators.

2—1250 KVA Elliott 3/60/480 V. 3600 RPM generators dir. con. to 150-200 lb. IP 600° TT turbines with dir. con. exciters surface condensers and pumps.

MERCURY ARC RECTIFIERS

QU.	KW	KIND	DC VOLTS	TRANS.
3	4500	Multi Anode	600	13800
2	3250	Ignitron	650	33000
2	1850	Ignitron	360	33000
1	1000	Ignitron	600	13800

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	VOLTS-D.C.	A.C.	RPM
1	1500	West.	250	4600	514
1	1000	G.E.	600	13200	514
1	500	West.	125	2300	720
2	250	C.W.	125/250	220/440	1200
1	200	G.E.	250/275	2300	1200
1	75	Ster	240	440	1200
1	75	West.	125	440	1200

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
2	1500	G.E.	2400/4160	900
1	1500	G.E.	4600	900
1	1000	West.	2300	900

SYNCHRONOUS MOTORS—60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
1	800	Ideal	4160/2400	1200
1	600	G.E.	440	360
2	350	G.E.	2300	257
1	300	G.E.	2300	660
1	300	West.	2300	900

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	3125	G.E.	25/60	300
1	3000	G.E.	60/25	300
2	2500	G.E.	25/62½	750
1	2450	G.E.	62½/25	750
1	1250	G.E.	25/60	300
1	1250	West.	25/60	300
2	1000	G.E.	25/60	300
1	500	Al. Ch.	25/60	300

TRANSFORMERS—60 CY.

1— 7500 KVA G.E. 138000—41000, 3 ph.
3— 3333 KVA West. 132000—7820/13200 Y
1— 2000 KVA G.E. 69000—13800/23900 3 ph.
1— 7000 KVA Al. Ch. 66000—2400, 3 ph.
3— 1000 KVA West. 66000—7200
1— 2500 KVA G.E. 59.75 KV, 5 taps, 3 ph.
3— 100 KVA West. 44000—7200/12470 Y
3— 75 KVA G.E. 44000—2300/4000
3— 8333 KVA West. 43800—13900
4— 6667 KVA G.E. 38100/66000Y—12700/22000 Y//13200
1—18750 KVA A.B.B. 34840—11000, 3 ph.
2—15000 KVA Al. Ch. 33000—12500, 3 ph.
2— 7500 KVA Al. Ch. 33000—13800, 3 ph.
1— 1500 KVA G.E. 33000—2300/4600, 3 ph.
3— 667 KVA G.E. 33000—2300/4600
6— 75 KVA Mal. 33000/16500—2300/6900
1— 50 KVA G.E. 33000—2300
2— 4500 KVA G.E. 27000—2300, 3 hp.
3— 3750 KVA West. 26400/13200—2400
4— 450 KVA Al. Ch. 25410/44000—13280/23000
2— 1000 KVA G.E. 22000/11000—2300, 3 ph.
3— 750 KVA West. 13200—440
3— 333 KVA G.E. 13200—2400/4160
3— 333 KVA West. 13200—440
3— 200 KVA G.E. 115000—220/110
3— 200 KVA Mal. 11000—2300
3— 167 KVA G.E. 7200/12400—240/480
1— 1500 KVA West. 4600—2300, 3 ph. Auto
3— 250 KVA Al. Ch. 2300—460
6— 75 KVA G.E. 480—120/240

OIL CIRCUIT BREAKERS

1— 600 A. 73 KV G.E. FHKO-139 Outdoor
1—400 A. 37 KV G.E. FHKO-236-500 Outdoor
1—1200 A. 34.5 KV G.E. FKO-339-1000 Outdoor
4— 600 A. 15 KV G.E. FHKO-139-750 Outdoor
2— 600 A. 15 KV West. B-28-B-500 Indoor

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2—70,000# 500 psi
2—60,000# B&W 450# superheat
2—30,000# B&W 450# superheat
1—1250 B & W Sectional header 200#—super
1—1000 HP Erie City Boiler, 200#
1—700 HP B & W Sectional header—Super
6—486 HP B&W Stirling, Super 200#
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2— 5,000 KW Turbo-Generator—Cond.
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2— 2500 KW Turbo-Generators and Condensers
3— 2,000 KW Turbo & Condenser
2— 1,500 KW " " " } Also 400# & 600# turbo
2— 1,250 KW " " "
2— 1,000 KW " " "
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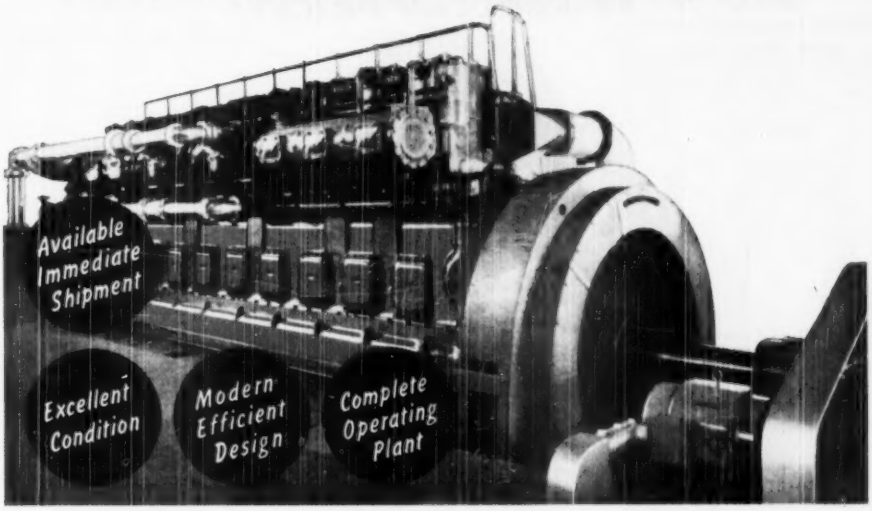

1675 KVA 50° Fairbanks-Morse alternating current generator 3 phase 60 cycle 2400/600/480 volts
300 RPM direct connected to
1750 HP Fairbanks-Morse Diesel Engine, 2 cycle, 10 cylinders, Model 33E16, 300 RPM.

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2—New 500 HP, 1200 RPM Elliott, 220/440 V., 3 Ph., 60 Cy., Shaft 4½" dia. x 8" long. (Photo right.) Control Available.

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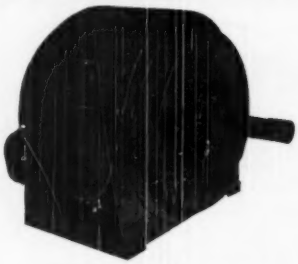
KW	D.C. Volts	A.C. Volts	Mfg.
500	250	2200	G.E.
400	125/250	2300	Ideal
300	125/250	440/2300	Allis (New)
200	250	2200	Whse.
200	125/250	2200	G.E.
150	250	440	G.E.
125	125/250	2300	G.E.
100	250	220/440	Star
75	250	440	Allis
60	250	220	G.E.
50	250	440	Ideal(New)
30	250	440	Ideal
7½ VS	250	220/440	Rel (New)

Reconditioned and guaranteed

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
900	150	440	G.E.	80%
650	138	2300	Whse.	Engine
500	514	440	E-M	100%
400	900	2300	Whse.	80%
400	720	440	G.E.	80%
350	200	2300	Whse.	100%
300	720	440	Whse.	80%
250	600	4160	E-M	100%
250	514	2300	A-C	90%
150	900	2300	G.E.	100%
150	1200	440	G.E.	80%
75	900	220	E-M	80%



SLIP RING—R & G.

HP	RPM	Volts	Mfg.
1500	514	2300	A-C
800	514	2300	Whse.
500	450	2300	G.E.
450	514	440	Whse.
400	720	2300	G.E.
350	450	2300	Whse.
300	900	440	G.E.
300	600	440	G.E.
200	1200	440	G.E.
150	1200	2300	G.E.
50	720	220	Whse.

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6—250 HP 440/3/60 Fully Magnetic, Reversing, 7 steps acceleration, Allis-Chalmers, with air ckt. brkr. Open or enclosed.

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230 Volt Drip proof — ball bearing

Qu.	HP	RPM	Mfg.	Frame
3	3	690/2660	G.E.	284
10	5	850/1700	G.E.	CD-66
5	7½	575/1750	G.E.	CD-77
1	10	575/2300	L.A.	4051
3	10	1750	Rel.	T-34
2	30	850/1700	Rel.	T-230
5	250	1750	A-C	149

Reconditioned and guaranteed

230 VOLTS D.C.

HP	RPM	Mfg.	Brg.
250	400/1200	E-D	Ball.
200	400/1200	Rel	Ball.
150	350/1200	Whse.	Ball.
100	475/1350	E-D	Ped.
75	500/1500	C-W	Sleeve
50	400/1200	G.E.	Sleeve
50	350/1050	Whse.	Ball.
40	400/1600	C-W	Ball.
30	400/1200	Rel (TEFC)	Ball.
30	700/1400	Rel (TEFC)	Ball.
25/30	500/1500	Rel	Ball.
25	690	Rel	Ball.
25	400/1600	Rel	Ball.
20	300/1200	Rel	Ball.
15	575/1000	Rel	Ball.
15	700/1350	Rel	Ball.
10	600/1200	Rel (TEFC)	Ball.
10	850	Rel	Ball.
7½	400/1600	Rel	Ball.
7½	600/1800	Rel (TEFC)	Ball.
7½	200/1200	Whse (TEFC)	Ball.
5/7½	400/1600	Whse	Ball.

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1—3500 KW, 2300 V, 150# Cd.
1—3000 KW, 2300 V, 150# Cd.
1—2500 KW, 480 V, 150# Cd.
1—2500 KW, 550 V, 250# Cd.
2—1800 KW, 2300 V, 400# Cd.
1—1000 KW, 2300 V, 260# N.C.
2—1000 KW, 250 DC, 200# N.C.
1—1000 KW, 2300 V, 185# Cd.
2—1000 KW, 480 V, 180# Cd.
1— 750 KW, 2300 V, 175# Ex.
1— 750 KW, 550 V, 170# Ex.
1— 750 KW, 240 V, 150# Cd.
1— 500 KW, 2300 V, 175# Ex.
1— 300 KW, 2300 V, 200# N.C.
1— 300 KW, 2300 V, 150# Cd.
1— 150 KW, 2300 V, 150# N.C.
1— 100 KW, 125 DC, 125# N.C.
1—20,000 KW, 25 cycle

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2—50,000#, 300#
1—30,000#, 425#
1—35,000#, 150#
3— 750 Hp., 200#
2— 500 Hp., 200#
3— 500 Hp., 400#
1— 438 Hp., 200 #
2— 400 Hp., 150#
4— 150 Hp., 165# SC. Mar.
1— 240 Hp., 100# SC. Mar.

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3—375 KVA, 550 V. Uniflow
1—312 KVA, 440 V. Uniflow
1—166 KW, 240 V. Uniflow

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1—465 HP, 800# N. C.

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TOP QUALITY POWER EQUIPMENT

1—1300 H.P., Walsh Widener Sectional Header Boiler, 225 lbs., 1926.

1—680 H.P. Babcock & Wilcox Sectional Header Boiler, 200 lbs., 1925.

1—300 H.P. Bros Brothers, Type A, Water Tube Boiler, 1940, with stokers.

1—150 H.P. Erie City, Economic, 1926, 125 lbs.

1—175 H.P. Titusville Scotch Marine, 1944, 125 lbs.

2—250 H.P. Erie City, 3 drum Bent tube, 1934, 250 lbs.

1—300 K.W. Gen. Elec. geared Turbine, 5100 r.p.m. to 1200, 3 phase, 60 cycle, 230 volts.

2—300 K.W. Gen. Elec. geared Turbines, 5100 r.p.m. to 1200, 600 volts D.C.

1—Western Precipitator with induced draft fan.

2—Babcock & Wilcox chain grate stokers.

MUrray Hill 2-9098

WARNER J. SHERB, INC.

342 Madison Ave., New York, N. Y.

POWER EQUIPMENT—READY TO SHIP

Q.	HP	Make	RPM	Type
1 New	250	West.	1200	Syn.
1	250	G.E.	1150	I. E. Vert.
1	250	G.E.	1150	(2200 V.)
1	250	Burke	720	(2200 V.) Syn.
1	200	West.	720	CS-954A
1	200	G.E.	860	(2200 V.)
1	200	Al. Ch.	1800	(2200 V.)
1	200	G.E.	1800	T. S. Syn.
1	175	West.	600	C. S.
1	175	West.	1200	Hi Torque
1	150	West.	257	Syn.
1	150	West.	900	(2300 V.) Syn.
1	150	G.E.	900	ATI Syn.
1	150	West.	1200	MS Hi Torque
1	150	West.	560	CS-954A
2	150	L. Allis	1775	FX
1	125	Fl.Mh.	164	Syn.
1	125	West.	450	CS
1	150	West.	600	Syn.
6 New	125	West.	1200	Syn.
1	112	West.	1200	Syn.
1	100	FM	360	Syn.
1	100	Al.Ch.	720	
1	100	West.	900	Syn.
1	100	West.	600	Syn.
1	75	Fl.Mh.	900	Syn.
1	75	Stanley	600	
1	75	Al.Ch.	585	
1	75	L. Allis	1150	Hi Torque
1 New	60	Rell'co	1200	TEFC BB
1	75	L. Allis	1775	FX-505
1	75	Master	1750	TEFC
1	60	Al.Ch.	515	
6 New	60	West.	900	Exp. Proof
5 New	60	West.	900	TEFC
1 New	60	Rell'co	880	TEFC
1	60	G.E.	1800	
1	60	FM	1200	Syn.
1	50	G.E.	720	KT-336
1 New	50	Rell'co	720	TEFC
2	50	G.E.	720	KT-346
1	50	Wagner	900	Fvnn Meichel
1 New	50	Rell'co	900	TEFC
1	50	G.E.	1200	
1	50	West.	1735	CS
1	50	Wagner	1750	TEFC
2 New	50	Reliance	1750	TEFC (2200 V.)
2 New	50	G.E.	1750	TEFC (2200 V.)
1 New	50	West.	1750	TEFC
2	40	G.E.	870	KT-546
1 New	30	G.E.	900	Hi Torque
1 New	30	West.	900	Hi Torque
1 New	30	L. Allis	1800/1200	
1	30	G.E.	1730	TEFC
1	25	West.	880	TEFC
3	25/6.2	Cont'l	1150/575	
1	25	West.	1150	CS-W-405
2 New	25	G.E.	1760	K-3642

GEAR MOTOR BARGAIN

50 HP G. E. 1755 rpm input 13 rpm output speed 220/440 or 550 v. A.C. 3 ph. 60 cy. splash proof ball bearing.

SPECIAL BARGAINS
Diesel Engine Generator Sets

10—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 150 HP Model GBD-8, 5½x7, 8 cyl. Superior DIESEL Engines, also, start with engine panels

4—100 KW same as above with 220 or 440 v. NEW A.C. Generators

1—63 kva. 120/208 v. 3 ph. 60 cy. 1800 rpm., driven by Cat. DIESEL mt'd on trailer

1—90 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 360 rpm DIESEL

1—75 KW 220/440 v. 3 ph. 60 cy. International GASOLINE

2—75 kva. 220/440 v. 3 ph. 60 cy. Delco Cummins DIESEL

1—62 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 1200 rpm DIESEL

2—37½ kva., 220/440 v. 3 ph. 60 cy. Buda DIESEL

10—NEW 37½ kva., 220/440 v. 3 ph. 60 cy. LoNol Gasoline

1—31.3 kva. 120/208 v. 3 ph. 60 cy. G.E. Gen. driven by LoNol GASOLINE

11—NEW 25 kva. 120/230 v. 1 ph. 60 cy. Le-Roi GASOLINE

3—25 KW BRAND NEW Onan 220/440 v. 3 ph. 60 cy. 1800 rpm GASOLINE

1—12½ kva. 120/240 v. 1 ph. 60 cy. 1200 rpm., dir. con. Hercules GASOLINE

2—12 kva. 120/240 v. 1 ph. 60 cy. LoNol GASOLINE

2—7½ kw. 120/208 3 ph. 60 cy. Buda GAS.

230 V. SERIES WOUND MOTORS

HP	Make	Type	RPM
15	G. E.	CO-1807	900
11	Westg.	K-5	470/630
40	Westg.	K-9	700

SLIP RING MOTORS—3 ph. 60 cy.

HP	Make	Rpm	Volts
600	Ideal	1770	220/440
500	Ideal	1770	220/440
400	Ideal	1770	220/440
400	West.	870	2200
75	G.E.	450	220/440
60	G.E.	570	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	Kva	Make	Rpm	Volts
6 NEW	100	West.	1200	220/440
10 NEW	37½	West.	900	220/440
3	25	Onan	1800	220/440
11 NEW	25	West.	900	220/440
		(1 ph.)		

MOTOR GENERATOR SETS—250 V. D.C.
Motors 220/440 volt or 2200 volt

No.	KW	Make	Rpm
2	200	Westinghouse	1200
1	100	Westinghouse	700
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	580
1	100	Delco	1200

125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw. West. 125 v. 1200 rpm. 220/440 v. 3 ph. 60 cy. Syn.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva	Make	Pri.	Sec.
1	500	Standard	2300	575/460/345 230/115
3	500	G.E.	2300	230/460
6	333	Maloney	2300	230/460
3	300	G.E.	2300/4000	230/460
3	150	West.	2400/4160	240/480
3	150	Pgh.	2300	230/460
1	100	Peerless	2300	230/460

ENGINES

NEW 75 HP, P.&H. Model 387C 3 cyl. Diesel
Rebuilt 32 HP, Caterpillar Model D-3400 Diesel
NEW 42 HP, International Model D-4 4 cyl.

NEW AXIAL FLOW VENTILATING FANS

20—6000 cfm Sturtevant Bulletin 512389 2" stat. pres. 7 blade dir. con. belt HP 1765/1178 rpm 220/440 v. 3 ph. 60 cy. Westg. TEFC Motors

5—5000 cfm 2.2" stat. pres. Sturtevant with 3 speed 220/440 v. 3 ph. 60 cy. Motors

2—10,000 cfm LAIDEL dir. con. 2 speed 220/440 v. 3 ph. 60 cy. Motors

1—12000 cfm 3" stat. pres. with 2 speed 220/440 v. 3 phase 60 cy. Motors

2—16000 cfm 3" stat. pres. Buffalo Forge with 3 speed 220/440 v. 3 ph. 60 cy. Motors

1—67000 to 38000 cfm 1" to 0.3" stat. pres. Size 56" dia. 72½" L, 2 sets propellers International Eng. Co. driven by 100 HP AC Motor

A. C. HOISTS

2—NEW ½ ton Shaw 220/3/60 15' lift 21 fpm

230 V.D.C. MOTORS

5—New 250 HP, Allis Chal. 1750 rpm
1—60 HP, Westinghouse 850 rpm
3—50 HP, Westinghouse 1700 rpm

PLATING SETS

1—1000 amp. 25 v. G. E. driven by 40 HP 230 v. D.C. 1200 rpm mtr. (Like New).

1—50 KW, Chandeysen 20/40 v. sh. wd. dir. con. 75 HP 220/440 v. 3 ph. 60 cy. syn. motor.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

DIESEL ENGINES
AIR COMPRESSORS
PUMPS • MOTORS
• GENERATORS •

We deliver and install.....

VISIT US AT THE
POWER SHOW
BOOTHS
552-553

LIEFKE DIESEL & COMPRESSOR CO.

57-25 COOPER AVENUE BROOKLYN 27, N. Y.
TELEPHONE: HEGEMAN 3-4335

Our 30th Year

HEMPHILL EQUIPMENT PROVES ITS VALUE

Member of The National Industrial Service Association, Inc.

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1000	GE	Pyranol	3	4150 x 2400
1	1000	GE	Auto	3/2	4150 x 2400
1	1000	GE	Auto	3	2810Y-2300Y
1	800	Kuhl.	ODSC	1	4600 x 2300V
3	400	GE	H	1	6900 x 2250V
1	300	Pitts.	ODSC	1	7800 x 440V
3	300	GE	H	1	2400 x 120/240
1	200	Whse.	Auto	3/2	4150 x 2300
1	200	Pitts.	OISC	1	4000 x 110/220
1	200	GE	Auto	3/2	4150 x 2400
1	150	GE	KS	1	2300 x 230
1	100	Pitts.		1	2750 x 110/220
3	100	Wagner	RCKV	1	240 x 120/120
2	100	Whse.	SK	1	4400 x 220/440 Taps
2	100	Newark	Dry	3/2	440 x 220

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
2	1500	GE	600	275	4000 Syn.
1	1000	GE	514	600	4000 Syn.
1	1000	GE	514	600	2300/4150 Syn.
1	300	GE	1200	250	2300 Syn.
1	150	GE	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El.Mach.	1200	125	4150 Syn.
2	75	GE	1200	125	220/440 SC
6	75	GE	1200	60	220/440 SC
1	50	Ridgeway	1200	550	220/440 SC
1	50	Whse.	900	250	220/440 SC
2	40	El.Mach.	1750	125	440 SC
1	35	Ideal	1200	125	220/440 SC

SLIP RING

1	2500	GE	MT	6600	257
1	300	Whse.	CW	440	600
1	250	Whse.	CW	440	600
1	200	Whse.	CW	440	600
1	100	GE	IM	440	400
1	75	GE	MT	220	1200 Vert
1	75	GE	MT	440	900
1	60	GE	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1720
1	50	GE	MT	220	1200
1	50	Whse	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1200
1	40	GE	MT	2200	1200

This Seal is *Your Guarantee*

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK — LONGACRE 5-3227
PHONE NEW JERSEY — UNION 3-2600

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu.	HP	Make	Type	Volts	RPM
1	400	G.E.	IK	2300	514
1	400	G.E.	KT-412	2300	450
1	400	G.E.	KT-412	550	450
1	300	Al. Ch.	AR	440	1760
1	250	Whse.	CS	2200	1160
1	200	Al. Ch.	AR	220/440	580
2	125	Al. Ch.	AR	2200	1750
1	125	Whse.	CS-761	440	1750
1	125	Whse.	CS-772	2200	1170
3	125	C.W.	129Q	440	420
2	100	Whse.	CS-662	440	1750
1	100	Al. Ch.	AR-326	2200	1160
1	100	G.E.	KT-556	2200	865
5	100	F.M.	H8-201C	440	880
7	100	Al. Ch.	AR	550	690
1	100	Al. Ch.	AR	440	575
1	100	F.M.	H-241B	440	450
1	100	Whse.	CS-926	2200	514
1	100	Al. Ch.	AR	440	695
1	75	G.E.	I-15-K	220	570
2	75	Al. Ch.	AR	2200	1765
1	75	Whse.	CS	440	1750

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu.	HP	Make	P.F.%	Volts	RPM
1	450	G.E.	80	440	360
1	400	Whse.	80	440	600
1	268	Al-Ch.	100	2200	900
2	250	Al-Ch.	90	2200	514
1	200	Whse.	80	440	360
1	150	G.E.	100	2200	900
1	150	G.E.	80	550	450
1	150	Whse.	100	2200	400
3	125	El. Mch.	100	4800	900
1	125	G.E.	80	2200	900
5	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
1	100	Whse.	100	2200	1200
2	100	G.E.	80	440	600

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu.	HP	Make	Type	Volts	RPM
1	2000	G.E.	MT	2300	356
1**	2000	G.E.	MT-50	2300	240
1**	1500	Al. Ch.	ANY	2200	230
1**	1200	Cr. Wh.		2200	237
2**	1000	Al. Ch.	ANY	2200	235
2	1000	Whse.	CW	2200	444
1**	800	G.E.	MT-12	6600/2200	300
1**	600	G.E.	MT-412	2300	710
2	500	G.E.	I-16-M	2300	450
1***	400	G.E.	MT-574	550	585
1	400	G.E.	I-EI7-M	2300	875
1**	400	G.E.	I-M	2300	590
1**	400	Al. Ch.	ANY	2200	595
2	400	G.E.	MT-412	2200	440
1	300	G.E.	I-EI5-M	2200	1200
1	300	Al. Ch.	ABY	2200	595
1	250	Al. Ch.	ABY	440	440
1	250	Whse.	CW-1106	2200	580
1	240	Whse.	C.W.	550	514
1	250	G.E.	MT-414	2200	300
1	150	G.E.	I-EI3 M	2200	1750
1***	125	Whse.	C.W.-870	2200	900
1	100	Al. Ch.	ABY	440	1160
1	100	F.M.	420-C	440	900
1	75	G.E.	I.M.	440	695
1	50	G.E.	MT-536	2200	1150
1	50	Al. Ch.	ABY	440	850

—Mill type pedestal bearing. *—3-bearing.

TRANSFORMERS—(OIL COOLED)

Qu.	K.V.A.	Make	Type	Ph.	Volt
2	4500	G.E.	HC	3	27900/13500/2300
3	500	G.E.	H	1	13200/11880/220/440
3	200	Pitts.	OISC	1	14400/12600/220/440
3	150	Pitts.	OISC	1	33000/22000/2300/4600
3	150	G.E.	H	1	19000/9500/550/2300
3	100	Whse.	SS	1	12075/10955/230/460
3	100	G.E.	H-KP	1	4160/120/240
3	75	G.E.	H-KP	1	2400/4160Y/120/240
3	50	Al. Ch.	OISC	1	2200/220

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	VOLTS DC	VOLTS AC
2	1500	G.E.	600	600	4160/2300
1	1250	Al. Ch.	720	525	4800/2400
2	1000	G.E.	514	575	4000/2300
1	600	Al. Ch.	720	525	2200/440
1	500	Al. Ch.	720	525	2200/440
1	200	Ridgeway	900	275	2300
1	155	G.E.	720	250	2200/440
3	150	C.W.	900	250	2200/440
1	100	Ridgeway	1200	275	1000/2200
1	100	Delco	1200	120/240	2200/440
1	75	Whse.	900	75	2200
1	75	Al. Ch.	900	250	2300
2	75	Star	1200	250	440/220
1	50	Reliance	1750	250	440/220
(4 Units Variable Voltage Set with 5-K.W. Exciter)					
1	35	G.E.	1750	125	440/220
1	30	Reliance	1750	250	440/220
2	25	Whse.	1200	120/240	440/220
1	9	G.E.	1750	250	440/220

Available for inspection on its original foundation (1) 1500-KW Westinghouse M-G Set, 250-VDC, 514 R.P.M., comp. interpole: 2150-HP, syn. motor, .80 P.F., 514 R.P.M., 4600 Volt, 3-ph., 60-cy (will reconnect for 2300-V), with complete DC and AC panels and reduced voltage starting equipment for syn motor.

DIRECT CURRENT MOTORS

Qu.	HP	Make	Type	RPM
1	1500	Whse.	Encl.	600
2***	1250	Whse.	Mill	300/600
6***	800	Whse.	Encl.	600
1	400	Al.Ch.	Mill	400/1200
1***	350	G.E.	MCF-4	200/600
1	350	G.E.	CD-169	1150
1	325	Whse.	QM	450/900
1	200/250	El. Dy.	Z-22	400/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
1	150	Al.Ch.	Mill	400/1200
2*	150	Cr.Wh.	SC-H	800
1	100/125	Rel.	1995-T	300/1200
2	100	Rel.	1650-T	400/1200
1	90/160	G.E.	MPC-6	625/1125
1	75	Whse.	SK-151L	300/1200
1*	50/75	Rel.	1995-F	300/1200
1*	30/75	Whse.	SK-151L	400/1200
1	50	Whse.	SK	300/1200
2	35	G.E.	RF-14	500/1500
1	32½	Whse.	SK-150	400/1200
1	30	Al.Ch.	E-145	400/1200
1	30	G.E.	SDM-105	875/1750
2	27½	El.Dy.	15-S	450/1350

All above are 230-VDC except where marked ***
*** are 525,600-VDC pedestal bearing mill type
*—T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — PHILADELPHIA, PENNA.

220 440 Volt, 60 cycle **SQUIRREL CAGE** open, 3 Phase

GUARANTEED REBUILT

QN.	HP	MAKE	TYPE	BEARING	SPEED
1	200	G.E.	IK	S.B.	900
1	200	G.E.	IK	S.B.	720
1	150	G.E.	IK	S.B.	900
1	150	G.E.	IK	S.B.	720
1	150	G.E.	IK	S.B.	1800
2	125	Kiliq		B.B.*	1800
1	100	West.	MS	S.B.	1200
1	100	West.	CS	S.B.	720
2	100	G.E.	IK	S.B.	720
1	100	G.E.	KT-347	S.B.	1200
2	100	G.E.	IK	S.B.	900
1	100	G.E.	IK	S.B.	1800†
3	100	G.E.	IK	S.B.	1800
1	100	West.	CS-504	S.B.	1800
1	75	G.E.	IK	S.B.	600
2	75	G.E.	IK	S.B.	720
2	75	West.	CS-752C	S.B.	900
1	75	G.E.	K-505	S.B.	1200
1	75	G.E.	IK	S.B.	1800†
2	75	G.E.	IK	S.B.	900
4	75	West.	CS	S.B.	1200
4	75	G.E.	IK	S.B.	1200
2	75	F.M.	QS-445	B.B.	1800
2	75	G.E.	IK	S.B.	1800
1	60	G.E.	KT-348	S.B.	900
1	60	G.E.	IK	S.B.	1200
1	60	F.M.	QS-444	B.B.	1800
1	60	G.E.	KT-333	S.B.	1800
4	60	G.E.	IK	S.B.	1800
1	50	G.E.	IK	S.B.	600
5	50	West.	CS	S.B.	900
1	50	G.E.	KT-342	S.B.	900
1	50	G.E.	KT-342	S.B.	900†
2	50	West.	CS-445	S.B.	1200
1	50	G.E.	KT-327	S.B.	1800
2	50	G.E.	IK	S.B.	1800†
3	50	G.E.	IK	S.B.	1800
1	40	G.E.	KT-342	S.B.	720
1	40	F.M.	BH12D	S.B.	900
1	40	G.E.	KT-336	S.B.	900
1	40	West.	CS	S.B.	1200
2	40	G.E.	IK	S.B.	1800†
2	40	G.E.	IK	S.B.	1800
1	35	G.E.	IK	S.B.	720
1	35	Triumph	B12	S.B.	900
3	30	G.E.	KT-312	S.B.	1800
3	30	G.E.	IK	S.B.	1800
5	30	West.	K-365	S.B.*	3600
1	25	G.E.	IK	S.B.	720
1	25	F.M.	B12P	S.B.	720
1	25	Century	SC-30	S.B.	1200
1	25	F.M.	BH12A	S.B.	1200
1	25	Ideal	A 18	S.B.	1200
1	25	West.	CS-471	S.B.	1800
1	20	F.M.	KBV	B.B.	1200
1	20	G.E.	KT-322	S.B.	1200
1	20	G.E.	KT-312	S.B.	1200
1	20	G.E.	K-364	S.B.	1800
1	20	West.	CS-364	S.B.	1800
2	20	G.E.	K-320	B.B.	3600
4	20	Lim-Weld	Frame 326	S.B.	3600
2	15	West.	CS	S.B.	720
1	15	Wagner	15 T	S.B.	1200
1	15	Ideal	A	S.B.	1200
1	15	G.E.	KT-502	S.B.	1200
1	15	G.E.	KT-752	S.B.	1800
1	10	G.E.	IK	S.B.	1200
1	10	G.E.	KT-752	S.B.	1200

* Splash proof † 2200 volt

SLIP RING MOTORS

We offer from stock the following 220/440 volt, 60 cycle, 3 phase, GUARANTEED REBUILT equipment, unless otherwise noted.

QUAN.	H.P.	MAKE	TYPE	SPEED	DESCRIPTION
1	15	G.E.	MT 512	900	S.B.
1	30	G.E.	MT 332	900	
1	30	Al. Ch.	ANY	600	
2	40	Al. Ch.	ARY 444	1800	splash proof, B.B.
1	40	G.E.	MT 336	900	S.B.
1	50	G.E.	I-M	900	S.B.
2	60	G.E.	MT 556	600	
1	60	G.E.	MT 346	900	
1	80	G.E.	I-M	900	
1	80	West.	CW 505	1200	
1	75	G.E.	I-M	720	
1	100	G.E.	I-M	720	
1	100	G.E.	I-M	900	
1	125	G.E.	I-M	720	
1	150	G.E.	I-M	600	
1	150	G.E.	I-M	1800	2300 volt
1	200	G.E.	I-M	600	

TOTALLY ENCLOSED, FAN COOLED, BALL BEARING, 220/440 volt, 60 cycle, 3 phase, GUARANTEED REBUILT, unless otherwise noted.

QUAN.	H.P.	MAKE	TYPE	SPEED	DESCRIPTION
1	7½	G.E.	KF 284	1800	
1	7½	Reliance	AA 324	1200	XP, NEW
3	10	L.A.	JB 326	1200	
1	15	West.	CB 326	1800	XP, NEW
1	25	L.A.	JB 364	1800	
1	40	G.E.	K 486	1800	XP, NEW
1	50	Master	FB 404	3600	XP, NEW
1	50	Al. Ch.	ARZZ 444	1800	NEW
1	75	G.E.	K 505	1200	

POWER EQUIPMENT COMPANY

8 CAIRN STREET — P. O. BOX 534 — ROCHESTER 2, N. Y.

Telephone: Gen esee 5629

Immediate Delivery

1—5000 *KVA., GEN. ELEC., TRANSFORMER*, 3 PHASE, 60 CYCLE, Type HT, Form DH, 33,000 Volts Primary with 4—2½% taps below; 2300/4600 Delta and 4000Y Volts Secondary.

3—250 *KVA., WESTGH., TRANSFORMERS*, 1 PHASE, 60 CYCLE, OISC, out-door, 22000/21450/20900/20350/19800—2300 volts.

ARCHER & BALDWIN, INC.

75 West Street New York 6, N. Y.
Tel: EOwling Green 9-9275 & 9-9276.

BOILERS

10 to 1000 H. P.

NEW-USED RECONDITIONED

Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

ONE STEAM POWER PLANT

2000 K.W. 3 PHASE 50 CYCLES 6300 V.

EIGHT (8) TURBO-GENERATORS:

Four (4)—250 KW A.C. plus 40 KW D.C. 250/450 V 3 phase, 60 cycle or 200 KW plus 30 KW D.C. 220/380 V—50 cycle Mfg. by General Electric Co.

Two (2)—300 KW D.C. 120/240 volt 6 Pole—3 wire—Comp. Wound Turbine by Worthington Moore. Generator—Allis-Chalmers.

Two (2)—300 KW D.C. 120/240 volts. Comp. Wound Turbine by J. Hendy. Generator—Westinghouse.

Packed in Original Crates

Complete Specifications and Details Upon Request

International Fermont Machinery Co., Inc.

115 BROADWAY NEW YORK 6, N. Y.

3078 CFM I. R. COMPRESSOR
NEW 1945 — USED ONLY 6 MONTHS

Type PRE-2, 30x18x21, #C46345 & #C46346, 110# discharge pressure, 180 RPM, with intercooler and aftercooler. Direct connected to 500 HP, G. E. synch. motor #6293018, Type TS, 3/60/2200 volts, with 7½ KW, 125 volts M.G. Set for excitation & starting panel.

6—100 KW WORTHINGTON DIESEL UNITS
Originally Used As 2—300 KW Power Plants
Will Sell Individually or As Complete Plants

Model BB-5, 5 cylinders, 600 RPM, direct connected to Westinghouse, 125 KVA Generators, 3 phase, 60 cycle, 230 or 460 volts.

Completely equipped with Evaporative Cooler, Starting Equipment, Switchboard and Silencers.

These units were never commercially used—run for test purposes only.

ABOVE UNITS LIKE NEW—BARGAIN PRICE—FOR IMMEDIATE SHIPMENT

NEW X. P. MOTORS
CLASS 1 GROUP D — 3/60/220/440 VOLTS

Quan.	HP	Make	Frame	RPM
1	50	A. C.	445-S	1770
1	40	A.C.	444	1770
1	30	A. C.	405	1760
5	20	A. C.	326	3550
1	20	A. C.	404	1160
2	20	A. C.	364	1750
4	15	A. C.	365	1160
9	5	A.C.	284	1160
3	3	Cr. Wh.	224	3460
2	2	A. C.	224	3300
3	1½	A. C.	204	3500
1	1½	A. C.	204	1730
2	1½	A.C.	204	1160
1	1	Cr. Wh.	204	1200

(Above Is Only Partial Listing of Motors. We Have a Quantity of TEFC and Gear Motors In Stock.

Heat and Power Co., inc.
70 PINE STREET — **DIGBY 8-0373** — **NEW YORK 5, N. Y.**

Special—Immediate Delivery

4—604 H.P. Each—B&W, forged steel sectional headers, straight tube boilers, A.S.M.E.—250 lbs. working pressure—Insured by Hartford for 250 lbs. to Dec. 31st, 1950—Also available are B&W superheaters, soot blowers, boiler trim, boiler feed pumps, feed water heaters and other size B&W sectional header boilers.

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Phone — MUrray Hill 2-8562-63-64

FOR PROMPT DELIVERY

3—259 H.P. Union Iron Works straight tube, box header boilers, 180# pressure, Elesco Superheaters 100°.

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ELECTRICAL CABLE
- for every industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

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Boilers, water walls, stokers, turbo, steam and Diesel Electric units, transformers, air compressors and large motors.
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Diesel Gasoline and Steam Generators.
Electrical and Industrial Equipment
POWERITE CORPORATION
140 Cedar St. New York 6, N. Y.
Dept. 105 BA 7-8199

TRANSFORMERS
FOR SALE

2— 150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
6 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

ATLANTIC TRANSFORMER CO.
5143 N. 2nd St. Philadelphia 20, Pa.

FOR SALE
Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

500 HP Bros W.T. Boiler, Bros Sprdr. stkr. $7,000
500 HP Vogt W.T. Boiler, Firite Spr. stkr. $7,000
260 HP Vogt W.T. Boiler, Westghse Undf. " $4,500
216 HP Vogt W.T. Boiler, compl. new tubes $3,500
2—150 HP HRT boilers, shell only, $750 & $1,000
Westghse Underf. stkr. 114' gr., prac. new, $2,000

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MOTORS • GENERATORS • TRANSFORMERS

200 KW M.G. SET

200 KW Westinghouse NEMA Frame Generator 250 V. DC 1200 RPM direct Connected to
300 HP. Westinghouse Synchronous Motor 3/60 220/440 Volts 1200 RPM.
AC & DC Panels—Like new. Ship now.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 HP. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP. 3/60/440/1800 Gen. Elect. Motor.

600 HP REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL Size 30/16 Speed 730 RPM to 115 RPM.

25 CYCLE TRANSFORMERS

3—1667 Wagner transformers. 1 Phase 25 cycle 23000 Volts primary. 575 Volts secondary.

MOTORS

60-50-25 Cycle in Stock—All Sizes
Slip Ring—Squirrel Cage—Synchronous
All types of Control Equipment.

ALL ITEMS IN STOCK FOR IMMEDIATE SHIPMENT

NIAGARA TRANSFORMERS

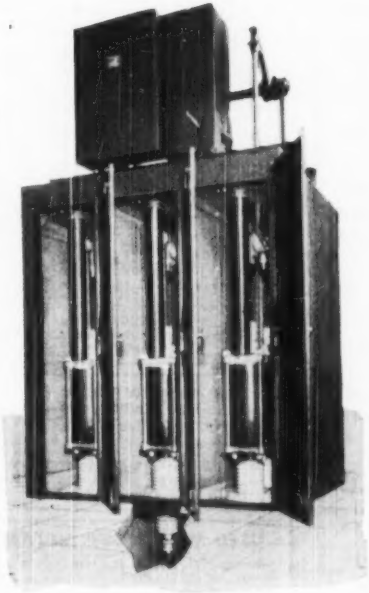
1 Phase — 60 Cycle — New

Stock Shipment on sizes listed. Short delivery on sizes up to 5000 KVA—1 or 3 phase, in voltage ratings to 69 KV. Standard taps. Built to A.I.E.E. —N.E.M.A.—A.S.A. Standards.

LISTING OF TRANSFORMERS

Quantity	KVA	Primary	Secondary
3	15	7200/12470Y	240/480
3	15	2400/4160Y	240/480
3	25	2400/4160Y	120/240
6	25	2400/4160Y	240/480
3	25	7200/12470Y	240/480
3	37½	2400/4160Y	120/240
3	37½	2400/4160Y	240/480
6	50	2400/4160Y	240/480
3	75	2400/4160Y	240/480
3	167	2400/4160Y	240/480
3	167	2400/4160Y	120/240
3	250	2400/4160Y	240/480

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL 4758



POWER CIRCUIT BREAKERS
GE HEAVY DUTY FH 126
34.5 KV 1500 MVA 1200 A
IN
MASONRY CELLS
STEEL CELLS

GUARANTEED PROTECTION
AT REDUCED PRICES

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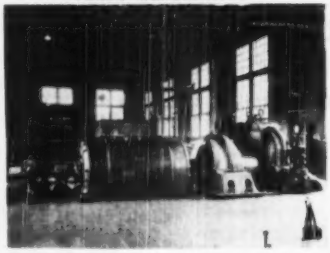
AVAILABLE FOR IMMEDIATE SHIPMENT • *still in original location*

INVESTIGATE THESE BARGAINS!

TURBO GENERATORS



3750 KW — WESTINGHOUSE - PARSON 3 phase, 60 cycles, 600 volts, 4020 RPM—complete with accessories.

1000 KW — WESTINGHOUSE-PARSON 3 phase, 60 cycle, 600 volts, 1800 RPM—complete with accessories.

625 KW — WESTINGHOUSE - PARSON 3 phase, 60 cycle, 600 volts, 3600 RPM—complete with accessories.

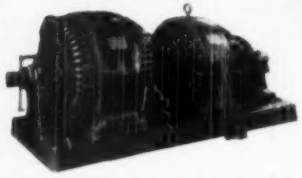
500 KW — WESTINGHOUSE - PARSON 3 phase, 60 cycles, 600 volts, 3600 RPM—complete with accessories.

AIR COMPRESSORS

MESTA MACHINE 2-stage, cross compound, 5080 cu. ft. air per minute, Stroke 48", Engine Drive (Mesta)

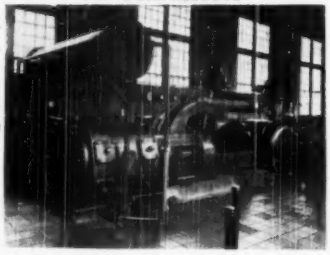
WORTHINGTON PUMP 2-stage, cross compound, 1715 cu. ft. air per minute, Stroke 42", Engine drive (Laidlow)

MOTOR GENERATOR SET



WESTINGHOUSE 500 K.W.—Compound Interpole, 230 volt, 2000 amps, 1200 RPM, coupled motor drive with 720 HP, 3 phase, 60 cycle, 550 volt, 745 amps, 1200 RPM motor and control

AIR COMPRESSORS



WORTHINGTON PUMP 2-stage, 2350 cu. ft. air per min. With REED Air Filter, Stroke 18", Motor Drive, 400 HP, 3 phase, 60 cycle motor with exciter

CHICAGO PNEUMATIC 2-stage Duplex Tandem, Size 23x13x18", 3480 cu. ft. air per minute, Motor Drive, 600 HP, 3 phase, 60 cycle motor, with exciter

HALL STEAM PUMP 2-stage, cross compound, 1715 cu. ft. air per minute, Stroke 42", engine drive (Hooven, Owen, Rentschler)

All of the above now installed and can be seen just as taken out of service recently

PARTIAL LIST—Merely a few items from the large selection of this type equipment

McKEES ROCKS INDUSTRIAL ENTERPRISES

NICHOL AVENUE **Phone FEderal 1-0746** **McKEES ROCKS, PA.**

(formerly Pittsburgh plant Pressed Steel Car Co.)

DIESEL ENGINES FOR SALE

1—Worthington D-5, 5 cylinder, 375 HP, Full Diesel Engine, direct connected to 250 KVA General Electric Alternator.

1—Worthington BB-6, 6 cylinder, 180 HP, Full Diesel Engine, direct connected to 150 KVA General Electric Alternator.

1—General Motors ELG-371, 3 cylinder, 2 cycle, 45 HP, Diesel Engine, direct connected to 37.5 KVA Alternator.

Misc. lot of switch gear and panel, auxiliary equipment, meter transformers, air compressors, tank, circulating pumps, and different types of electric switches.

THE F. E. SCHUMACHER CO. **Hartville, Ohio — Phone 311**

FOR SALE AT REAL BARGAIN PRICES

(1) GE 150, I-M, Frame 17, 2200/25cy/500 rpm, 3 phase
(1) GE 250, ITC, Frame 5017A,2200/25cy/500rpm, 3 phase
(1) GE 250, I-M, Frame 17A,2200/25cy/500rpm, 3 phase
(1) GE 300 I-K, Frame 17A,2200/25cy/500 rpm, 3 phase
(1) Allis, 500 HP, 440/25/490 rpm, 3 phase 3 bearing
(1) GE 300, I-M, 2200/60/450 rpm, 3 phase
(1) GE 300, I-M, 440/60/900 rpm, 3 phase
(1) GE 200, I-L, 2200/60/514 rpm, 3 phase
(2) West. 200, CW, 2200/440/60/600 rpm, 3 phase
(1) GE 200, I-M, 2200/440/60/800 rpm, 3 phase
(1) GE 150, I-M, 2200/440/60/720 rpm, 3 phase
(1) GE 150 I-M, 3 bearing, 440/60/3/450 rpm
(1) GE 150, ITC 8-15, 440/60/3/720 rpm
(1) GE 125, MTC 5356, 440/60/3/720 rpm
(1) GE 112, ITC 5014, 440/60/3/600 rpm

E. P. DIETRICK
829 Richmont St. Scranton 9, Pa.
PHONE 3-7357

The Stephen A. Douglass Co.

Condensing & Non-cond.:
TURBO-GENERATORS

Efficient, High Grade
Boilers to meet your needs

Diesel Electrics
all with LOW capital cost.

SOME SPECIAL OFFERS

2—1000 KW, 2—500 KW Non-Cond. Turbines
2—10,000 KW Cond. Turbo-Generators
3—10,000# Int. Furn. Boilers, 2—200#, 1-400#
1—600 HP Boiler, Cross Drum, 200#
1—575 KW Diesel Set, 360 r.p.m. (Never used)
1—150 KW Diesel Plant, in 2 UUnits, 514 r.p.m. (Excellent)
4—1000 KVA Transformers, 13,200/2400 V. 1 ph. and others.

? *On what capacity units shall we quote you* ?

630 Fort Washington Ave., N. Y. 33, N. Y.

FOR SALE

ALL EQUIPMENT IN SERVICE WHEN REMOVED. MOTORS MOSTLY GENERAL ELECTRIC OR WESTINGHOUSE 115-Volts D.C.

3—5-HP
2—3-HP
1—2-HP
3—1.75-HP
3—1-HP
4—½-HP
1—1/3-HP
1—¼-HP
1—.085-HP

1—New 20-HP with starter, 1750 RPM
1—Corliss Engine direct connected to 100 KW, 125 V, D.C. Crocker Wheeler Generator, 150 RPM
1—Motor generator, Westinghouse, 220 V, 3 phase, A.C., 125 V, D.C., 75-HP, 50 KW, 1150 RPM

Make offer one or all

MODEL LAUNDRY-CLEANER
1023 Linden Avenue
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USERS OF DIRECT CURRENT

We can supply you with guaranteed used equipment for converting AC to DC at a saving. Also Motors, Transformers and control.

C. B. LOCKE CO.
308 Tennessee Ave., Charleston 32, W. Va.
Telephone 3-8136

1000 KW DIESEL GENERATOR SET

G.E. 3 phase, 60 cy., 2300 V.

Complete with starting equipment & switchboard, $35,000 overhauled & ready to ship.

A. T. METTLER
904 Pacific St., Brooklyn 16, N. Y.
STerling 3-6515

USED WATTHOUR METERS

150 only G.E. 5 Amp. 1-14 110 Volt 2 wire Meters. All good—removed from lines to make way for 15 Amp 3 wire Range load.

KENWOOD ELECTRIC CO.
Sherrill, N. Y.

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	G.E.	1800
500	2200	G.E.	450
450	440/220	Whse.	514
200	440	Whse.	3600
250	440/220	Whse.	600
300	440	G.E.	450
125	4000/2300	G.E.	1800
150	440/220	Whse.	900
150	440/220	Whse. (3)	1800
150	440/220	G.E.	720
125	4000/2300	G.E.	1800
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900
100	2200/550	G.E.	1800
80	440/220	G.E. (MEC)	900
75	2200/550	G.E.	1800

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2300/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	WH.	ITT	600
250	440/220	G.E.	ATI	600
250	4000/2300	Wl. Mehy.	Syn.	600
240	2300/440	G.E.	ATI	720
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
119	440/220	G.E.	TS	857
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

GENERATOR SETS

2—unused 25 kva. 120/240 v., 3 ph., 1200 rpm. generator dir. conn. to Waukesha 6 cyl. gas engine

CIRCUIT BREAKERS

2—2000 amp., GE E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
3—1200 ampere, Whse., 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2300	Cr. Wh.	SC	1800
350	2200	G.E.	KT	1200
300	2300	G.E.	FT	3600
300	2200	G.E.	KT	1800
250	2300/440	L. Allis	OMS	1200
200	440	G.E.	IK	514
200	440/220	Whse.	GS	1200
200	440/220	G.E.	KT	1800
200	2300/440	G.E.	KF	720
200	2300/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	Whse.	GS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	H. Reg.	1200
150 vert.	440/220	G.E.	KTF	1200
150	440/220	G.E.	IK	514
150	440/220	Whse.	GS (NEW)	900
100	2300/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva. 600 rpm. 2300/440/220 V., G.E.
1—250 kva. 720 rpm. 2300/440 v., G.E.
1—225 kva. 600 rpm. 220/440 v., G.E.
1—225 kva. 720 rpm. 2300/440 v., G.E.
1—150 kva. 900 rpm. 480/240 v., G.E.
3— 75 kva. 1800 rpm. 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
350	230 (3)	G.E.	CD	1150
250	230 (3 new)	Cr. Wh.	CMC	1800
150	230	Cr. Wh.	TSCC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	BK	850

MOTOR GENERATOR SETS

1—300 kw, 1200 rpm, 250 v., G.E., connected to 500 hp, 1200 rpm, 2300/440 v., synchronous
1—185 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp, 1200 rpm, 440/220 v., squirrel cage
1—100 kw, 850 v., Bertner, 1200 rpm, connected to 150 hp, 2300/440 v., synchronous
1—75/90 kw, 250 V., 1200 rpm, G.E., conn. to 125 hp, 440/220 V., sq. cage
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2300/440 v., syn. motor.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage

TRANSFORMERS 60 Cy.

2—667 kva. Whse., 33,000—2300 V.
3—333 kva. G.E., 13,200—2300 V.
2—333 kva. Whse., 2400—480/240 V., Dry
3—250 kva. G.E., 6900/13,800—230/460 V.
3—250 kva. Whse., 11,000/22,000—2300 V.
3—250 kva., Whse., 2300—208 V.
3—200 kva. Whse., 13,200—2300 V. (Inertaire)
4—150 kva. Al. Chal. 2400—240/120 v.
1—150 kva. Whse. SK., 13200-125/215 v., 3 ph
3—100 kva. Whse., 4600/2300—230/115 V.
2—100 kva. G.E., 4600/2300-230/115 v., NKW
3—100 kva. G.E., 650-115/230 v., dry, 1 ph. new
3—75 Kva. G.E., 480—240/120 v. Pyranol
3—50 kva. G.E., 480—240/120 V., Pyr

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

VERTICAL HYDRO-ELECTRIC UNITS FOR SALE

We have many available from 50-1200 KW* Heads of water from 10' to over 100'.

1—144 KW 3 phase 60 cycle 550 V 120 RPM for 10-12' head
1—250 KW for 18'-22' head like new
1—400 KW for 28'-30' head
1—1200 KW new, never uncrated, for 26' head
2—Horizontal units 300 KW for 50-60' head
2—Horizontal units 600 KW for 50' head
1—18" Leffel scroll turbine only for head from 60-200'

Write for data on size needed, stating head in feet, and we may be able to furnish a unit to fit at a very reasonable price.

WM. C. MOULTON ASSOCIATES
MONSON, MASS.

DIESEL ELECTRIC GENERATORS

2—G.E. (NEW) 750 KW, 2400/480 Volts. 3/60, 720 RPM

1—Westinghouse (NEW) 500 KW, 2400/480/3/60/720

3—100 KW, 440 volt 3/60/1200

Each direct connected to General Motors Diesel Engine and complete with new, modern Switchboard.

SEE THESE UNITS OPERATED UNDER FULL LOAD IN OUR PLANT.

Sundfelt Equipment Company, Inc.
220 Hudson Street, Seattle 8, Wash.

600 KW DIRECT CURRENT GENERAL MOTORS DIESEL SET

Westinghouse Generator 500 Volt, 720 RPM, Electric Start. Unused.

450 HP ENTERPRISE DIESEL ENGINE

Model DSG-6, 6 cyl., 4 cycle, 450 RPM air start, solid injection unused.

Other sizes in stock from 10 to 1000 KW.

ALJOHN DIESEL CO., INC.
904-10 Pacific St., Brooklyn 16, N. Y.
STerling 3-6515

BOILERS

10 to 5000 H.P.

Diesel, Steam Turbine, Engine

GENERATORS

Heavy Power Equipment
Industrial — Chemical Process Equipment

UNUSED — RECONDITIONED

DEAN G. STRICKLER & ASSOCIATES
1346 Connecticut Avenue, N.W.
Washington 6, D. C. • DuPont 3286

MOTOR GENERATOR SETS

150 K.W. 250 Volt D.C. Gen. Elec. 3 Brg.; 440 Volt 3 Phase 60 Cycle 1200 R.P.M. Synchronous Motor
125 K.W. 250 Volt D.C. Burke 440 Volt 3 Phase 60 Cycle 900 R.P.M. Synchronous Motor
100 K.W. 250 Volt D.C. Gen. Elec. 3 Brg. 440 Volt 3 Phase 60 Cycle 900 R.P.M. Synchronous Motor
50 K.W. 250 Volt D.C. Westing. 4 Brg. 220/440 Volt 3 Phase 60 Cycle 1200 R.P.M. Motor
20 K.W. 125 Volt D.C. Allis Chalmers 3 Brg. 440 Volt 3 Phase 60 Cycle 1800 R.P.M. Motor

MOTOR REPAIR & MFG. CO.
1557 Hamilton Ave., Cleveland, Ohio

FOR SALE

BURNERS

Used — Good Condition

REASONABLE

11—26" Type DB Coppus Dennis Fanmix Gas and Oil Burners. When operated at 25 p.s.i.g. will release approximately 75 MM BTU per hour. Nine Burners in use since 1944. Two Burners since 1947. Spare Parts for above Burners available.

WRITE: R. E. Elwell
CITIES SERVICE REFINING CORP.
FRANK BUILDING
LAKE CHARLES, LOUISIANA

BOILER

Union Iron Works, 535 h.p. horizontal tubular Boiler, 3 drum, A.S.M.E. Code, 199# steam pressure, complete with the following: Superheater, boiler mater, soot blowers, electric eye, coal pulverizer, steel coal bin and bucket conveyor, new 1930, condition good. Sacrifice for quick sale.

Surplus & Salvage Co., Inc.
Jamestown, N. Y.

SELLING FOR CUSTOMERS

1000 KW, 2300 volt Gen. Elec. REBUILT condensing turbine 175 S.P.
300 KW 240 V Westinghouse geared Noncond turbine
400 KW 480 V 1200 RPM Elliott generator with 1200/4500 gear
285 KVA 240 V Cheo Inlflow engine set.
2000 Amp. 3-pole GE Air breaker with Bus Duct.
300 & 200 KW Syn M.G. Set with control.

H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

FOR SALE

VERTICAL MOTOR

U. S. 50 h.p., 220 volt, 60 cycle, 3 phase, vertical motor.

FS-8042, POWER
520 N. Michigan Ave., Chicago 11, Ill.

New and Used Equipment Available for

POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION

Send for new list to

EBASCO SERVICES INCORPORATED

APPARATUS EXCHANGE — Two Rector St., New York 6, N. Y.

SALESMEN WANTED

Protected territories open for men selling to Boiler Plants. Well rated, old established company has high profit plan for right men. Write,

THE WARREN REFINING CO.
750 Prospect Ave., Cleveland 13, O.

SALES ENGINEERS WANTED

Manufacturer of mechanical packings of unusual quality requires intelligent and aggressive representatives in Kansas, Missouri, Iowa, Minnesota, Dakotas, Nebraska, Maine, Vermont, Dallas area. Must be currently calling on principal consumers. No objection to non-competitive complementary lines. Liberal commission basis.

RW-8210, POWER
330 W. 42 St., New York 18, N. Y.

STEAM ENGINEERS with electrical experience to train as inspectors of Boilers and machinery for large Insurance Company. Minimum Requirements: Age 30 years; Education, High School; Experience, 5 years operation and maintenance. Normal starting salary with security, employee benefits, and promotion on merit. Reply stating age, experience, education.

P-7813, Power, 330 W. 42 St., N. Y. 18

(Continued from page 306)

SELLING OPPORTUNITY OFFERED

OPPORTUNITIES OPEN for sales representative with a large national manufacturer of power plant feedwater treatment and allied chemical lines for industrial plants. Established territories open. Mechanical or Chemical Engineering degree from accredited college or university required. Under 35 years of age, three years' experience in sales, engineering, production or related fields. Write fully, giving business history and salary requirements. All replies confidential. RW-8261, Power.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (40 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N.Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

WE DEAL in action: There are more attractive positions, higher salaries—and greater chances for advancement than you have enjoyed in the past. But they are attracted only by the man who employs the magnetism of professional selling procedure. If you are not satisfied with your present position, and are capable of earning $3,600 to $50,000 a year, our service secures interviews for better-paying executive positions. Constant contact major corporations Coast to Coast and Internationally. Write for complimentary booklet describing our confidential service. Executive Management Corporation, 625 Madison Ave., New York City 22, N. Y.

POSITION WANTED

POWER PLANT Operator, age 29 with eight years experience in modern power plant operation and maintenance, also some refrigeration. Technical school graduate. PW-7433, Power.

Engineers — Executives — Technical Men

Salaried Positions, $4,000 to $30,000

This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.

TOMSETT ASSOCIATES
1205-2 Berger Bldg., Pittsburgh 19, Pa.

POSITIONS WANTED

MECHANICAL ENGINEER—Twenty-five years experience, plant maintenance, operation modern power plants, refrigeration, air conditioning and water filtration plants. Fifteen years high pressure plants, some design and construction experience. Desire supervisory-engineer position with a utility, industrial plant or municipality. Registered engineer. Will relocate or travel. Available at once. PW-7948, Power.

POWER PLANT Engineer 39, B.S. deg. M.E. Men. A.S.M.E. experience: 10 yr. operation, maintenance, betterment, steam and diesel plants, 3 yr. electric welder. PW-7903, Power.

PLANT ENGINEER 25 years experience in power plants, boiler inspection work, cotton mills and finishing plants. Can engineer complete machinery installations. Has had a large amount of maintenance experience. Can do machine design. Holds National Board Boiler Commission and Mass. 1st Class Engineer's License. Age 54 years and married. Location not important. PW-8025, Power.

SELLING OPPORTUNITY WANTED

A WELL established incorporated company desires to represent a manufacturer of high grade power plant equipment in Northern Ohio territory. Address RA-7366, Power.

MANUFACTURER'S REPRESENTATIVE

Experienced sales executive seeking an industrial product or service for representation in East.

RA-8119, POWER
330 W. 42 St., New York 18, N. Y.

FOR SALE

Will sell outright or on royalty basis, all rights and patents on refractory furnace wall requiring no metal hangers.

Nationally advertised and exhibited — has given wonderful results in actual power plant operation. Owner and inventor wishes to retire from business. Act quickly.

BO-8179, POWER
330 W. 42 St., New York 18, N. Y.

New England Boiler Setting Co.
Specialists on
FIRE BRICK CONSTRUCTION
Industrial Furnaces
Expert Repairing
Stephen S. Donoghue
106 Webster St. Arlington 74, Mass.

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URGENTLY WANTED

1600 HP 2300/3/60/257 RPM motor with control, synchronous preferred would consider slip ring.
250 KVA water wheel plant, 63 ft. head, 3/60/550 or 2300 volt
3—250-500 KVA O.I.S.C. Transformers, 2300 or 4160 to 550 or
1—3 phase approx. 1000 KVA—60 cycle
75 H.P. 2300/3/60/3600 RPM motor.
1—3 or 5 HP 220/3/60 Dust proof Vertical motor approx. 250 RPM or gear motor with vertical downward shaft at 250 RPM.
3000 Amp plating generator with or without 550/3/60 motor.

Please add our name to your mailing list and send your Surplus lists of—Electric and Power Apparatus including—Steam Turbo Gen. Sets—Boilers—Diesel Sets—Transformers—Mining Machinery—Motors—Etc.

SOUL CLINIC, INC.
Calgary—Alberta—Canada

OFFICIAL PROPOSALS

ASWAN DAM HYDRO ELECTRIC SCHEME
EGYPTIAN GOVERNMENT
MINISTRY OF PUBLIC WORKS
HYDRO-ELECTRIC POWER COMMISSION
GENERAL ADJUDICATION

The Egyptian Government hereby announces that Tenders are invited for the supply, erection and maintenance of the Civil Engineering, Buildings, Penstocks and Other Works required for the construction of a Hydro-Electric Power Station at the Aswan Dam, all according to the Specification.

The Tender Documents comprising Conditions of Contract, Specification and Tender Drawings for the Entire Works may be obtained either at the Hydro-Electric Power Commission, Ministry of Public Works, Cairo, or the office of the Consulting Engineers of the Egyptian Government, Kennedy & Donkin, 12, Caxton Street, London, S.W.1., or from Royal Egyptian Legations in Washington, Paris, Stockholm, Berne, Brussels and Rome as from early December 1950.

Tenderers must pay LE.50 (fifty Egyptian Pounds) which covers the cost of the complete set of Tender Documents and Drawings. This sum must be paid to the National Bank of Egypt either in Cairo or in London to the credit of the Ministry of Public Works or at one of the above mentioned Legations, and will not be refunded.

Upon presentation of the Bank receipt to either the Hydro-Electric Power Commission in Cairo or the consulting Engineers in London or on the payment of the required sum at one of the above mentioned Legations, as the case may be, tenders will be supplied with the complete set of Tender Documents above referred to.

Firms who have already purchased the Tender Documents for the original Enquiry which was subsequently cancelled and who have not applied for a refund of the sums previously paid, will be able to exchange the original Documents for the new Specifications without further charge.

When submitting their tenders, tenderers must pay a provisional deposit of two per cent of the value of the Contract with a maximum of LE.100,000 (One hundred thousand Egyptian Pounds) to the National Bank of Egypt in Cairo or in London to the credit of the Ministry of Public Works. Letters of Guarantee from approved Banks will be accepted in lieu of cash. A list of approved banks is given in the Specification.

WANTED TO BUY

For Cash

YOUR SURPLUS
ELECTRIC MOTORS
MOTOR STARTERS
OIL & AIR CIRCUIT BREAKERS
CABLE-WIRING MATERIALS
PANEL BOARD FITTINGS
SPEED REDUCERS
COPPER WIRE

INDUSTRIAL ELECTRIC & SUPPLY CO., INC.
37-1681—Memphis, Tenn.—Box 1398

Air Compressors Wanted

Horizontal Water Cooled—Any size
also 2 Stage portable unit

L. W. BAUER
North Bergen, N. J.

WANTED URGENTLY

75 KW or 100 KW 250 volt D.C. Generator—low speed preferred.
Also a complete Motor Generator Set including: 75 KW to 100 KW 250 volt D.C. Generator—driven by a 2300/3/60 Motor, low speed preferred, complete with starter, rheostat etc.

SOUL CLINIC INC.
Calgary, Alberta, Canada

(Additional Wanted Ads on opposite page)

JOHN H. BENSON ROY L. WILIMZIG

PUMPS!!

2—20"x16" Economy AA511, 12000 GPM, 75' Hd. 1200 RPM; 300 HP Motor and starters; NEW 1948.

2—Ditto, except 40' Hd. and 900 RPM.

2—10"x8" Morris No. 6S Slurry Pumps, 900 GPM, 100' HD, 875 RPM, 60 HP, with or without motors.

1—Northern Hydraulic 3000 PSI, 99 GPM, Size 5820, 580 RPM, NEW SURPLUS.

1—4" GOULDS 500 GPM, 1320' Hd. 3500 RPM, Fig. 3360, 250 HP.

1000 OTHER PUMPS IN STOCK!
PHONE, WRITE OR WIRE!

C & S MACHINERY CO.
1708 N. 8th St.
St. Louis 6, Mo.
GA-4290

TWO STOKERS, COMPLETE

Detroit Overfeed Rotostoker—double feed. Capacity: 500 boiler H.P. Grate area: 45 sq. ft. Grate dimensions: 6 ft. x 7 ft. 6 in. Stokers complete with forced draft fans. Stoker parts: 4 feed units, 2 drive units, 2 blower fans, 2 wind tunnels, 2 set grates, 2 boiler fronts for mounting feed units.

PURITY BAKERIES
97 E. 12th St. St. Paul 1, Minn.

1—used—2 cylinder Upright Troy Twin Engine 75 H.P. with Moore & White variable speed change—owner used to operate paper machine.

THE WRENN PAPER COMPANY
Middletown, Ohio

NEW PUMPS

6—Allen-Billmyre Vacuum Pumps

450 CFM 12" suction, 30 H.P. motor. Less motors serial #4295254.

HERMAN MACHINERY & SUPPLY CO.
2110 St. Clair Ave., Cleveland 10, Ohio

2—ELLIOT TURBINE GENERATOR SETS

Gen.: 250 KVA 3/60/208V .8PF/1200 R.P.M. Turbo; Non. cond. 200 lbs. P.R. 100° Super heat. 5 lbs. Exh. 500 R.P.M. 294 H.P.

NOTE: ABOVE ARE COMPLETE WITH SWITCHBOARD AND EQUAL TO NEW. IMMEDIATE SHIPMENT

ALBERT HELLER CO.
210 Snediker Ave., Bklyn, N.Y. HYacinth 5-0800

STEEL STACK

60" by 175 ft ⅜" metal

Erie economic Boilers 100-150-200 H.P. 150# asme code.
400 H.P. Heine 200# boilers.
700 H.P. B.W. sectional header boiler 300#.
100 KW Direct current also A.C. 75 K.W. steam engines.

H. A. WOODWORTH
412 Greeley, Webster Groves 19, Mo.
Tele Republic 2-2300

Quality SINCE 1906 **Wente Motors**

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT... BY EXPERTS

SQUIRREL CAGE
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	G.E.	I (2200 V.)	900
2	50	Al. Ch.		900
1	60	G.E.	KT Vert.	1380
4	60	G.E.	KT (2200 V.)	1200
4	60	G.E.	KT547Y (2200 V.) 6P	1200
1	60	West.	CS (TEFCBB)	1200
1	75	West.	CS (TEFCBB)	1200
1	60	West.	CS Gearhead	233
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1200
1	120	G.E.	PT	2600
3	125	Al. Wh.	AR (BB)	450
2	150	Al. Ch.		1750
1	250	G.E.	KP (Vert.)	3600

SLIP RING—SYNCHRONOUS
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

1	50	Ideal	AV	600
1	50	G.E.	I	700
1	60	Ideal	AVX	1200
1	70	KW G.E.	TS (.7PF)	1200
1	75	West.	CW	400
1	75	G.E.	I	520
1	75	Fr. Morse	BV (2200 V.)	1800
4	100	G.E.	I-16 (2200 V.)	450
1	100	KW G.E.	ATB (.8PF)	900
4	100	G.E.	MT508Y (2200 V.) 8P	450
1	100	G.E.	MT556	900

Qu.	HP	Make	Type	Speed
1	125	Fr. Morse	T (2400 V.) (PF1.0)	900
1	150	West.	CW	450
1	200	West.	CW (3 Bear.)	600
1	655	Kva E.M.	L8 (PF)	900

D.C.—230 VOLT
(Other voltage as noted)

1	50	West.	SK	850
3	50	Reliance	T	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	500/1500
1	75	Diehl	K11	700
2	75/100	Reliance	T2050	300/900
2	75	West.	SK, frame 163	850
1	100	West.	SK, frame 180	1200
1	100	Cr. Wh.	CM	600
1	130	Cr. Wh.	CMC (550 V.)	1200
1	150	West.	SK	600/1200
1	150	West.	SK	350
1	200	Cr. Wh.	CM7	450
2	200	Reliance	T2850	300/900
2	200	G.E.	TLC-74	1250/4000
1	250	West.	SK	1050

M-G SETS

1— 45 KW West. 60 V DC—440 V AC 1200 RPM
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM
2— 75 KW El. Prod. 220 V DC—440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 900
1—100 KW Reliance 250 V DC — 220 V AC 1200
1—100 KW Ridge 275 V DC — 440 V AC 1200
1—150 KW G.E. 275 V DC — 440 V AC 900

ALSO—4000 motors other than listed from 1 HP to 300 HP.

The Wente Electric Co.,
Hamilton 203 NO. FOURTH ST. Phone 4-8128 Ohio

USED TURBINE-GENERATOR UNIT

One (1) 1,000 Kw. 80% P.F. 3 phase, 60 cycle, 2300 volts, 3,600 rpm Westinghouse Electric Corporation condensing turbine-generator unit designed for 200 psig. throttle pressure, 500° F. total temperature, exhausting at 1" Hg. absolute complete with direct connected exciter, and served by a 2,600 sq. ft. two pass, bottom inlet, C. H. Wheeler Manufacturing Company surface condenser, motor driven hotwell pump, air ejector, motor driven circulating pump and auxiliaries. All interconnecting piping included. This unit is available at the Municipel Electric Light Plant, Chambersburg, Pa.

Albert C. Wood Associates, Inc.
STOCK EXCHANGE BLDG.
PHILADELPHIA 2, PA.

FOR SALE
TWO 300 H.P. BOILERS & ACCESSORIES

Complete steam generating plant. Two Keeler Type CP, two drum, bent tube, water cooled furnace type boilers with heating surface 3000 sq. ft. each. W.P. 250 psi and nominal 300 HP each. Steam rating 9880 lbs. per hr. at 100% nominal rating. Riley-Jones stokers, single retort with moving grates 59 sq. ft. projected area, steam ram drive. Clarage fans 9825 c.f. per min. at 4 in., one steam turbine, one electric drive. Meters and instruments. Boiler feed pumps. Deaerating boiler feed water heater. All installed 1942. Now in use and good condition in northern Ohio. Available approximately Nov. 1951.

Contact BURGESS & NIPLE, *Agents*
584 East Broad Street Columbus 15, Ohio

MODERN AIR COMPRESSORS

6040 Ft. INGERSOLL RAND 60 LB. ELECTRIC.
1—3865 & 1—4486 Ft. NEW CHICAGO PNEU. OCE. ELEC. 125 LB. W MOTOR TO SUIT.
3176 Ft. SULLIVAN WN4 ELECTRIC. 125 LB.
1579 Ft. CHGO. PNEU. DIESEL. 125 LB.
1302 Ft. INGERSOLL RAND PRE-2 ELECTRIC. 100 LB.
610 Ft. WORTHINGTON V BELT DRIVE 125 LB. WITH OR WITHOUT MOTOR.

DARIEN, 60 E. 42nd St., New York 17, N.Y.

FOR SALE

2—255 HP, Type S Ingersoll-Rand Oil Engines, direct connected to 219 KVA, 2400 volts, 3-phase generators

1—275 HP PVG Ingersoll-Rand Gas Engine, direct connected to 237 KVA, 440 volt, 3-phase Westinghouse generator.

Units complete with switchboard panels, instruments and necessary accessories. Located: Chatham (Medina Co.), Ohio.

DYMO OIL CORPORATION
PO Drawer 550 Olean, New York

FOR SALE

2—General Motors model #16-278A Marine type Diesels, complete with General Electric AC generators 1250 KVA, 2300 volts. Excellent condition. Available immediately with full accessories. Write or wire for complete description and price.

CERTAIN-TEED PRODUCTS CORP.
120 E. Lancaster Ave. Ardmore, Pa.

URGENTLY WANTED

30x42 Jaw Crusher—second hand preferred—would consider new crusher but delivery is very urgent. 150 Hp. 2200/3/60 Slip Ring Motor with control and V belt drive.

If you cannot offer complete unit please quote on Crusher, Motor and drive separately, giving Price—Weight—Make—Condition and Location. RUSH.

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CALGARY—ALBERTA—CANADA

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No lengths too long or too short
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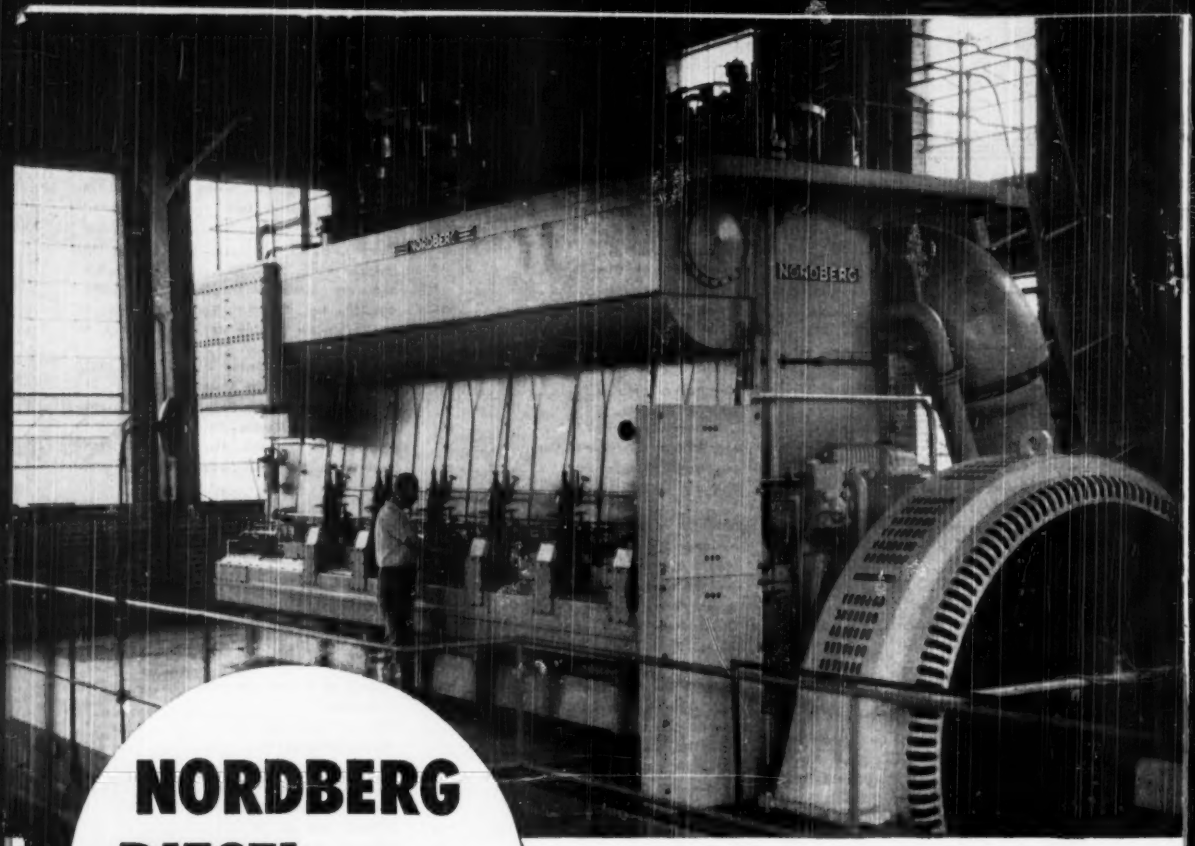

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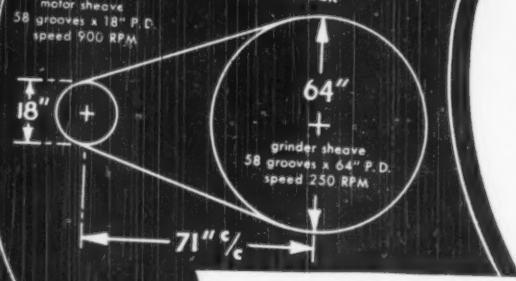

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